FOOD INDUSTRIES

manufacturing and processing

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Tariff Revision Suggestions That May Breed Trouble

IN THE FORTHCOMING tariff revision inevitably incidental to the recent election, Congress will be well advised, we believe, if it refrains from all gestures of a politico-economic sort. Although all are agreed that the American farmer shall henceforth share in the economic advantages of our protective tariff, action based upon that understanding must necessarily be confined to items in connection with which it is demonstrably certain that our farmers have a real and substantial interest.

In theory, all protective tariffs—our own included—serve to equalize the costs of production on items produced both here and in foreign countries. That being so, it is indeed difficult to take seriously the report that a duty is to be imposed on coffee, our popular non-food accessory from the tropics. Obviously we grow no coffee, nor ever shall. Whence originates this gratuitous affront to all coffee-growing regions is not apparent. Can it be possible that our American-made substitutes for coffee are confusing real competition with that of a fictitious sort?

Scarcely less bizarre is the suggestion by some one—perhaps the American apple grower—that a tariff be imposed upon bananas—the "poor man's dessert." This most important gift of the tropics supplements all Northern diets, and most wholesomely so. Possibly at times it supplants more expensive but not more delicious fruits, and true it is that calories are all more or less equivalent in the view of the statistician. But if that sort of special pleading is to guide Congress in its tariff-revision deliberations, troublous days for the new administration may well be ahead.

Retaining the Natural Color of Processed Foodstuffs

DURING the preparation and storage of many fruit products, the original fresh and attractive color fades or is changed to an unattractive hue. Some of these changes are caused by enzymes, others by simple oxidation, others by reaction with the metal with which the food comes in contact during preparation or storage. Another class of color change is little understood: apparently it is not due to metals, to enzyme action, or to oxidation. The metal effect is easily determined, and is prevented by the use of glass-lined processing equipment, or glass containers; or by the use of a metal that does not react with the product. Oxidase is easily destroyed by heat in most instances, at least in acid products such as fruit juices; and the complete removal of air before packaging—by vacuumizing—will usually inhibit oxidase action. The darkening of some decolorized syrups and concentrates, however, is another matter. Such products have been manufactured on an experimental and on a commercial scale in glass equipment; stored in glass in an almost complete absence of oxygen or oxidase, and still they have darkened. One theory to account for this suggests that a reaction occurs between the invert sugar and certain protein decomposition products such as the amino acids. The problem is a fascinating one and is receiving intensive study in several laboratories. The results are awaited with interest.

The Rôle of Copper in Human Metabolism

THREE YEARS OF RESEARCH, by Doctors F. B. Flinn and W. C. von Glahn, of Columbia University, whose work is described in the current issue of the *Journal of Experimental Medicine,* proves the harmlessness of copper in the quantities ordinarily found in food and drinking water. Incidentally, the findings refute the theory that copper may be the underlying cause of cirrhosis of the liver—the "poison" alleged to come from bootleg liquor prepared in copper stills.

Copper is widely distributed. The more recent research at Columbia demonstrated that it is found in the livers of numerous animals, in human and cow's milk, in almost all vegetables, in most insects, and in many marine animals. It takes the place of iron in the blood of lobsters and crabs—which reminds one of the first official bulletin issued in regard to the fatal illness of President Harding: that it was caused by poisoning from sea food caught in the region of the Alaskan copper mines!

The unthinking suspicion that has been cast on the red metal as the probable cause of poisoning and disease is almost entirely unjustified, as these investigators have proved. For the sequence to have been a logical one, however, the conclusions might well have preceded the work done at the University of Wisconsin, reported early in 1928, and released through the American Society of

Biological Chemists. This research proved the value of copper as a remedy for anemia, and hinted its importance as an essential body element.

Few metallic substances are poisonous if taken in minute quantities; but it is illogical to outlaw some of these because they are more toxic than others. Copper as a dye is barred from foodstuffs, but certain elements may act as catalytic agents in the human body, remaining undissolved and unchanged, although performing important functions in permitting reactions of far-reaching effect. Copper compounds are doubtless adsorbed on the organic cells of foodstuffs, and as such they should not be classed as toxic poisons.

Slow Drying and Fast Evaporation

THE respective problems of dewatering a solid and concentrating a liquid necessitate consideration of basic principles, which must be differentiated from one another if efficient and economical result is to be expected. In desiccation, disregarding procedure with finely divided particles, one should remember that fast drying may result in the formation of a hardened and almost impervious outer shell, which insulates heat from the interior and hinders the escape of water vapor. The time needed to reduce the entire mass to dryness is therefore inordinately delayed; the result bears no relation to the intensity of the heat applied, or the time required, and economy and efficiency are both sacrificed.

Another problem is involved, of course, when the alternative to a hasty drying that results in surface "crazing" is an equally undesirable mold; but, in general, manufacturers of food products will find that scientific control is practicable, not only as to the heat supplied, but also as to the degree of humidity maintained; for an atmospheric dampness, corresponding to the dampness of the material to be desiccated, is essential in the preliminary stages. In desiccation, strange as it may seem, the first act is to avoid drying. Instead, the temperature of the entire mass is raised, and case hardening is avoided, by the maintenance of an adequate degree of humidity in the atmosphere surrounding the material. When a uniformity of temperature has been reached, even to the center of each particle, the drying process begins, and applied temperature is gradually increased and humidity decreased so that the moisture escapes from the entire mass. In the long run, the most efficient result is achieved in the minimum of time and with the minimum consumption of heat units.

In the evaporation of water from a fluid, heat is customarily applied through a metallic wall. In this instance, the transfer must be rapid, and this is secured by insuring a high velocity of the liquid past the heating surface. The evils resulting from the stagnant contact of a fluid against a heating surface are too obvious to be enumerated. Much harm has been done to the market for processed food products by a failure to realize that a material may be ruined in taste and color by localized scorching during evaporation. This is not the only evil to be guarded against, however. If the heat applied is sufficient to form steam from the water in the fluid to be concentrated, and if the pressure is so low that this steam is released during heating, two hazards exist: The steam, as formed, acts as an insulator between the heating surface and the fluid, and the lack of contact results in the drying of the thin film of liquid covering the heating surface, the formation of scale, the spoliation of the entire product, inefficient evaporation, and low heat transfer. It is necessary, therefore, not only to secure a high rate of movement of liquid, but the escape of the liquid must be controlled so that steam is not released from the mass until after the heating surface is passed.

The foregoing may be included among fundamental principles that should be given careful consideration by those seeking a solution of existing troubles and inefficiency in dewatering practice, or those planning operations that are expected to yield satisfactory results. It is not wise to generalize, but in nine instances out of ten a defect in technical method may be traced to a disregard of basic reasoning, an unwise adherence to precedent, and a neglect to investigate. Efficient results are always explicable, usually in simple terms, and this axiom is of particular pertinence when considered in connection with drying and dewatering problems.

Humanitarianism Gains by Intelligent Control

PARADOXICAL though it may appear, a process for the production of a health factor, the need for which is widespread, has been patented for altruistic reasons and control of the process thus secured to the patentee for the life of the patent.

When Dr. Harry Steenbock, of the University of Wisconsin, discovered the process of imparting Vitamin D to foods and medicines by exposure to ultra-violet light, he at once demanded, as a true scientist, that the benefit of his discovery be made widely available. In the same spirit he methodically recorded and published his findings. His Vitamin D would cure rickets, make strong, healthy bones and teeth—every child should have it. But the process was one that presented possibilities for the charlatan and the fakir. In the hands of the unscrupulous it would be possible to destroy the great potential usefulness of the process—by such means as false advertising, baseless claims, and products void of Vitamin D.

Furthermore, the public should not be called upon to distinguish between the good and the bad. That being so, there seemed to be but one way to prevent exploitation of the public—by control of the process through the legal instrumentality of a patent. And so a patent was applied for and secured in the United States and in foreign countries. Steenbock could now leave his ill-smelling laboratory and garner for himself a fortune. The food industries were already manifesting a lively interest; others than the inventor saw the possibilities of his discovery. But he was more interested in research than in riches; besides, his university, in common with practically all institutions of learning, needed funds. With the help of alumni, the Wisconsin Alumni Research Foundation was organized, a corporation formed not for pecuniary gain, but for the promotion of scientific research at the University of Wisconsin. To this foundation Steenbock assigned all rights in his invention. Control had been secured because only licensees of the foundation could use the process; individual profits had been avoided through the medium of the foundation: the scientist could now return to his laboratory.

The foundation has announced the policy of granting licenses only to concerns whose ethical and business

standards cannot be questioned. It hopes to secure royalties on such a basis that the manufacturer need not increase the price of his processed commodity—all to the end that the public may find such products available at no increase in cost. When questions of improvements and refinements in the process have been determined with the minutest care, the foundation hopes to make licenses in the food fields.

Dubious Results From Trying to Legislate Profits

THE troubles under which the Australian canning industry is laboring are of two kinds. The first is related to over-production; the second is indirectly the result of legislatively pegging the price of sugar at a figure that, compared with world prices, is artificially high. The surplus of canned and preserved Australian fruits over domestic requirements must be marketed abroad, in competition with similar products from other countries. But unfortunately, in Australia the manufacturer must purchase domestic sugar at its artificial price to produce export goods to be sold in competition with goods manufactured with sugar purchased on world market prices.

The Australian canner contends that he should be allowed to purchase his domestic sugar at a price on a parity with world prices, or else be allowed to import foreign sugar and pay the duty. The only obstacle to these proposals is that neither scheme is permitted by the federal Australian government. Most vexing to the canner and preserver is the fact that the surplus of Australian sugar of all sorts is sold abroad on a parity with world prices, or, in simpler language, for whatever price it will bring. Sugar today costs $148 per ton within Australia, and yet the federal government has permitted Australian sugar to be sold to overseas competitors at $53.50 a ton, f.o.b., in recent years. Thus the domestic preserve manufacturer whose product is roughly 50 per cent sugar may grin if he can, but bear the burden he must, while contemplating the fact that his foreign competitor can buy half of his raw materials at prices substantially below Australian prices. Refined American sugar with draw-back benefit can be exported from New York—with cost, freight and duty paid—and laid down in Australian seaports at a price $12 per ton less than the fixed domestic price. Sugar from Java, the Philippines, or other nearer producing centers can be delivered still more cheaply to Australia.

The losses entailed by marketing at the lower price the exportable 30 per cent surplus of Australian sugar are borne by the sugar producers themselves, and as far as the sugar industry is concerned, the scheme seems to work satisfactorily. The canning and preserving industry, however, although it receives an export bounty amounting to 36 cents per dozen cans, is still unable to compete in world markets, and largely on account of the cost of domestic sugar.

In the United States it is hoped by some that legislation may be enacted to permit the disposal of the exportable surplus of farm products by making domestic users purchase foodstuffs at fictitiously high prices, while we are selling the surplus abroad at export prices.

Those interested in farm relief can find ample evidence in the Australian method of handling its sugar surplus on which to base an accurate prediction as to the outcome of the application of similar methods here.

Going Broke by Failure to Provide for the Future

IN THIS day of constant invention it is vital to the continued commercial success of any institution to be constantly carrying on a research program. The corporation that feels so secure that it does not require any further research is in danger of joining the no-dividend-payers, and from this doldrum the way out lies only through research and development. Competition is becoming more scientific every day.

The idea of research is one that irritates the reactionary mind. It frequently arouses visions of laboratories and much scientific equipment in which expense only can be visualized. But, if research means anything, it means doing, hunting—searching for the new or for the better. It implies a healthy dissatisfaction with the existing order.

It is far less expensive to do one's research now and obtain the desired results before they are actually needed than to experience the disagreeable surprise of finding that a competitor has already gained great advantage by several years of intensive work.

Where Was Your Bacteriologist on December 28, 1928?

ESSENTIAL to a complete knowledge of food preservation is a thorough understanding of bacteriology. In most fields of food manufacture, curing, spoilage, and molding play an important part in the technical problems of the industry. Usually, bacteriologists are employed regularly by the larger food companies, and there is an increasing demand for their services. Strange, therefore, was the absence of bacteriologists of food manufacturing establishments from so important a meeting as that of the Society of American Bacteriologists, held recently at Richmond, Va. Inquiry revealed the presence of only seven persons from a great number of plants that should have been far better represented, although the gathering was well attended by specialists in other fields of bacteriology, all of whom were amply repaid for the effort and expense of the trip.

At times, manufacturers are likely to forget the value of money invested in sending their professional staffs to such meetings. If the only purpose were to listen to scholarly papers presented to a learned group sitting in uncomfortable chairs, some justification might exist for keeping the bacteriologist at home and letting him read the scientific periodicals.

The greatest value of these conventions is in getting acquainted; forming friendships; receiving inspiration through an appreciation of how much is yet to be learned. If your bacteriologist has no professional friends, to whom shall he turn for suggestions and advice? Scientists, be it noted, help one another.

If a salesman could sit down for an evening to discuss his problems with the best merchandising counsel available in the country, his employer would benefit from the contact. The scientific meeting is a parallel case. Food industrial bacteriologists could have had the inspiration, advice, and counsel of the leaders of the profession if they had been more largely represented at the Richmond convention.

Complex Technic of

Meat Packing

Yields to Science

By Everett B. Wilson
Institute of American Meat Packers, Chicago

PROBABLY no other large industry handling perishable products has to deal with more numerous and complex operating and technical problems than the American packing industry. The packer's job is far from done when the meat animal has been slaughtered and dressed. Livestock come to market in varying quantities. The meat and meat products must be made available to consumers in an orderly manner; as far as possible, supply must be adjusted to demand. The greater part of the meat is marketed in fresh form, soon after the animals are processed; but the remainder, which is sold in frozen, dried, salted, pickled and smoked, cooked, and canned form, has given the packing industry many difficult problems to solve, in addition to those encountered when the meat is fresh.

At one time meat packing was a one- or two-man business. Even today some farmers perform for themselves the functions of the meat packer. The average farmer can do almost anything the packer does except freeze meat, and in winter he can do that. Why, then, has the job been transferred from the farmer, for the most part, and put into the hands of a large industry with a huge investment in land and buildings, equipment, and machinery? There are two reasons: First, one-half of the country produces far more meat than it uses and the other half produces much less than it wants to eat; that necessitates the shifting of supplies, a job for which a farmer is hardly equipped. In the second place, the packer, operating with large production, can make better use of the valuable byproducts, can perform the physical tasks more efficiently, and can apply the technical control which has proved so beneficial.

A brief description of some of the more important packing-house processes will bring out clearly the services of science and scientific control in the packing business.

In the early days meat packing was not the year 'round business that it is today. Operations could be carried on only in the cooler months of the year, because of the perishability of the product. Relief came when special rooms were fitted for refrigeration with cakes of ice, but it was not until the introduction of artificial refrigeration that meat packing could be carried on every day in the year, regardless of the season or climate.

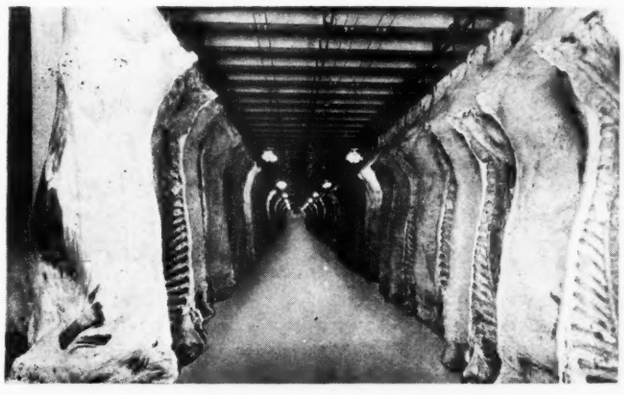
Fresh meat must be kept under constant refrigeration. It must be refrigerated at the proper temperatures until it is put into the hands of the consumer; and the housewife has learned that it is best for her to get the meat into the home refrigerator as soon as possible. The packer, having discovered the advantages and possibilities of refrigeration, has had the problem of finding out just

Chemical laboratory where meat packing processing is controlled

what temperatures should be used, and how to maintain them at the lowest cost. Only in the last few years has the industry learned that it could make appreciable savings by speeding up the time spent in chilling the dressed animals. Formerly 48 to 72 hours was required to chill the dressed animals to the point where they could be handled further and cut with the greatest efficiency. By adopting low-pressure, brine-spray refrigeration, the chilling now can be effected in eighteen hours, making the product available for distribution or curing so much sooner. In regard to the fresh product, the fact that livestock prices paid by the packer are based on the present and prospective demand for meat and byproducts makes it advantageous to be able to market the product before the wholesale prices have changed.

Cleanliness and sanitation play an equally important part in the handling of fresh meat and have been the subject of close control.

Meats which are to be sold without cure, but which are not to be sold promptly after processing, are frozen, although only a small proportion of the total meat supply is sold as frozen product. The packer has had the task

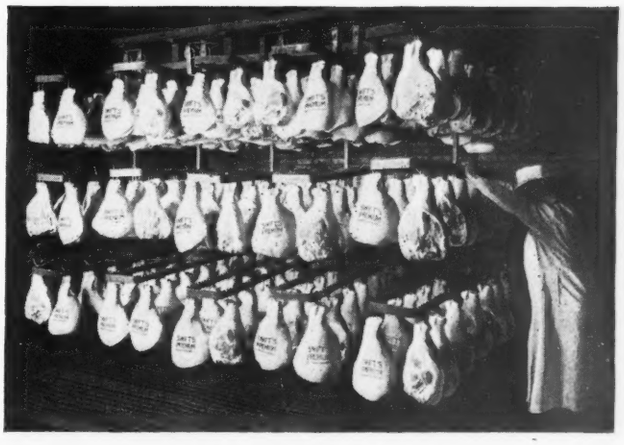


In a modern beef cooler

of finding out, first how to freeze the meat—whether to do it slowly or as rapidly as possible— and to de-frost it. Experience and experiment have taught the industry that quick freezing and slow thawing give the best results. Some packers feel that the newer knowledge of freezing and de-frosting methods may have a pronounced effect on merchandising methods in the future.

Meats which are to be cured—consisting mostly of pork cuts—present additional problems. It is not a difficult matter to cure hams and bacon with a sweet pickle and to smoke them, but doing the job right—that is, doing it according to the most modern methods—is a real science. First the meats must have been chilled to the correct temperature, which the scientist has determined. Then the pickle, if that method of curing is used, must be properly prepared and be of the correct strength and most favorable temperature. Only recently a marked improvement in curing methods was made possible after thorough experimentation with a new ingredient, sodium nitrite. Packers had been using sodium nitrite, which, to perform its function, must be converted into nitrite during the curing process. It was found that by using the nitrite as a prime ingredient the strength of the cure could be controlled far more closely, and the comparable cost of the new ingredient was considerably less than that of the one formerly used.

The functions of curing are to fix the attractive color of the meat and to impart keeping qualities and flavor.



Interior of smoke house

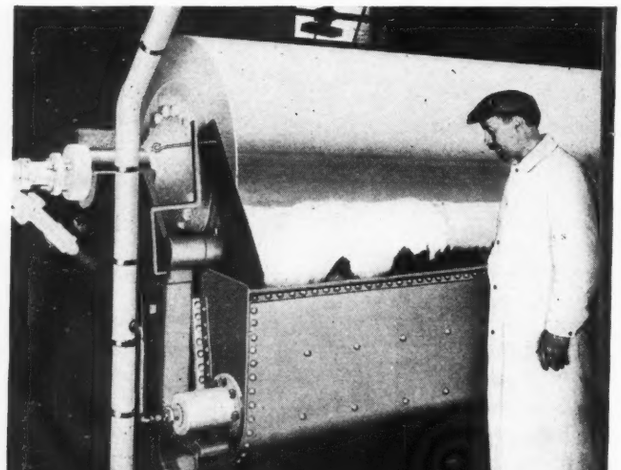
Since the value of the product depends to a great extent on these properties, it is important that the packer know how to control them most effectively and economically. Research has enabled the packer to market a cured product which has a more standard color and flavor, and of superior keeping qualities.

Curing once was done by guesswork—by rule-of-thumb methods which had been determined by chance. The curing process was almost as much a mystery to the packer as to the average consumer. Today the packer knows what is going on in his curing vat every minute; and he knows why. He checks his pickle at frequent intervals, and consequently has a greater percentage of first-grade product than he could have were his control not so close and were his methods less scientific. Curing ingredients now are thought of in terms of chemical properties, and not just as so many pounds of salt, or nitrite, or sugar.

Related to curing is the problem of shrinkage. The packer must make sure that his product does not lose moisture to the point where its palatabilty is affected; and he does not want the product to shrink between the time it is weighed and billed to the retailer and the time it arrives; moreover, each pound of shrinkage means one pound less to sell. Here again, control is of importance.

Where hams are cured

Smoking, which improves the keeping qualities of the meats by heating, and by the deposit of a small amount of creosote, is another step in the process which has been put on a scientific basis. It is interesting to observe that the smoke flavor, so desired by consumers today, probably was not an intentional addition to the product. At first the smoke was merely a byproduct of the fire which was added to the meat when the heat was applied. The flavor of the smoke, undoubtedly. is in part responsible for the fact that many consumers prefer cured and



Congealing lard in rolls

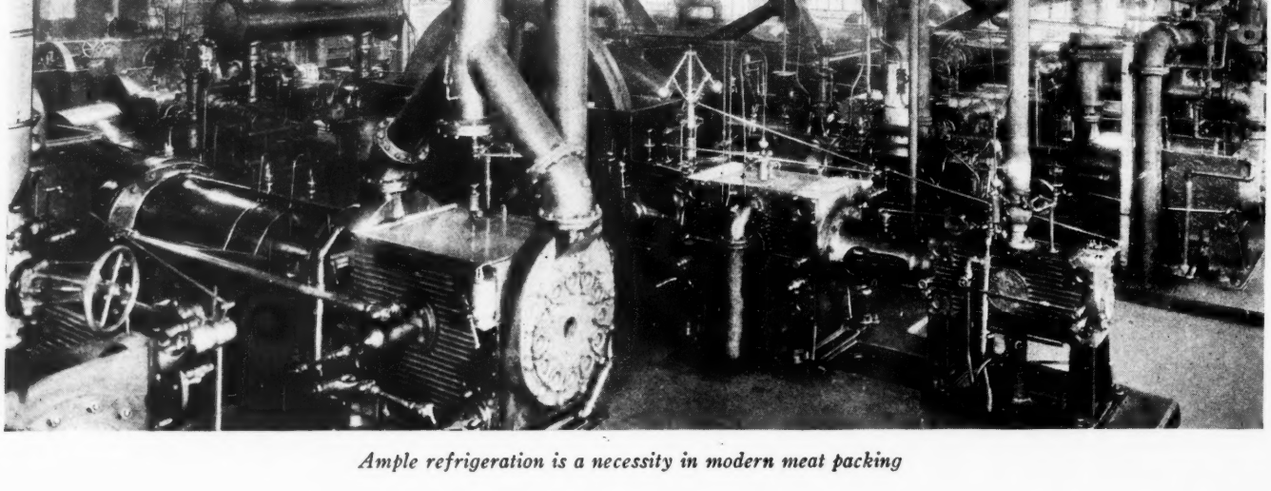
smoked hams and bacon to the same products in fresh form. Under modern methods of smoking, the quality of the wood used, the time of smoking, and temperatures and humidity are controlled closely.

Lard is another packing-house product requiring rigid control. Its importance to the industry is shown by the fact that 23 per cent of the total production of pork and pork products in 1927 was in the form of lard. Its manufacture may be a simple or a scientific process. The farmer's wife can make lard in her kitchen with a large kettle and a stove as her only equipment. She can produce a fine product if she is sufficiently skillful, but the chances are that her product may not have the perfect white color demanded by consumers who buy their lard in retail stores. It may have just the right taste, but it may be lacking in the keeping qualities so essential in a commerical lard. The packer's ability to produce a product of high quality, and produce it consistently, has created a wide market for packing-house lard. Through proper control, the packer is able to increase his yield of the best grades of lard and so standardize the quality of the product that the housewife can buy it by brand and know exactly what she is getting each time she buys.

Tallow, which is sold not to consumers but to other manufacturers or dealers, is sold according to specifications. The packer must check the product frequently for color and titer. The animal oils are tested for color, cold test, and clouding point. In the manufacture of stearine, color, acidity, and titer must be determined and controlled.

Inedible products, such as fertilizer, tankage, cracklings, and stick, all must be analyzed closely for the modern commercial market. Undesirable elements must be removed, not only to improve the quality of the product, but also to get the greatest value out of the products. The packer who sells too much grease with his tankage is penalized by the buyer of tankage because the grease is present; on the other hand he loses because he did not remove the grease and sell it to buyers of grease.

The many varieties of sausage and other ready-to-serve meats must be marketed with the best possible keeping qualities and with standard consistency and flavor. Some sausage is smoked, other varieties are cooked, and still others are frozen. The spices used in some varieties of sausage must be controlled and their strength determined to keep the product uniform. Oversmoking, faulty freezing, excessive shrinkage, or an improper mixture of meats, will reduce the sales value of the product.



Ample refrigeration is a necessity in modern meat packing

Making that extremely important packing house byproduct termed sausage

In the making of dry sausage, special drying rooms are utilized. The drying process is a far step from that employed by the American Indians and the white pioneers who dried venison for future use. By careful regulation of temperature and humidity, the drying process is controlled scientifically and accurately. If dried too much, the product will shrink excessively and crack; if marketed in too moist a condition, it will not keep well.

In the canning of meat, the problems are quite similar to those encountered by other industries which can food products. The packer has many steps requiring close control. The can itself must be properly constructed of suitable materials. The product must be in good condition and of proper quality. Cooking must be conducted at the proper temperatures and for the proper length of time. The problem of shrinkage has been solved, as with some other foods, by precooking the product before it is put into the can.

Technical control also enters into the purchase of supplies used in the packing house. Coal is bought, not by the price per ton, but on the basis of its heating units. Twine is valued according to its strength; salt according to its freedom from impurities; gasoline and lubricating and heating oils are valued according to their basic properties. Whenever possible, the packer prefers to buy and sell according to specifications.

It should be borne in mind, however, that the packer, regardless of his reputation for efficiency, still possesses many opportunities for further progress. He has some aims which may never hit the mark and some goals he may never reach, but the technical men of the industry see many possibilities: for example, they believe that the time required for the curing of a ham can be reduced from somewhere between thirty and sixty days to a few days; they believe that freezing methods can be improved to the point where the product will be practically unchanged in the freezing and de-frosting processes.

The technical men of the industry have made great progress in analyzing and identifying the factors which tend to decrease the perishability of meat products, and they believe that they can control perishability even more closely as time goes on.

Studies of curing methods, of methods of testing the stability of lard, of factors affecting perishability, and of other problems related to the industry, are being conducted in the Research Laboratory of the Institute of American Meat Packers, founded by Thomas E. Wilson, at the University of Chicago. Certain of the work has been made possible by fellowships, established through the generosity of men in the packing industry.

In addition to the research laboratory, the Institute maintains a Service Laboratory for the testing of packing-house products and supplies. This laboratory, which is patronized by many member packing companies of the Institute, is performing a valuable service to the industry. The counsel of the several scientists and packing-house specialists on the Institute staff is available to patrons of the laboratory in connection with their analyses.

The Institute of American Meat Packers is the trade, research, and educational association of the American packing industry. Its staff consists of ten service departments, including a Department of Scientific Research, a Department of Packing-House Practice and Research, a Department of Nutrition, a Department of Home Economics, and a Department of Waste Elimination.

Many of the problems of the packing industry are common to other industries. Some of them have been solved by men outside the industry. Many of the methods and processes commonly used by packers are now so well known and so easily utilized that they have lost their technical aspect entirely, but even this brief review makes evident the fact that the business of meat packing has become a highly technical one. The industry has made remarkable progress, considering the fact that not many years ago it was generally conducted by one man with a knife and an iron kettle.

New Sugar Mill Opens

The Southern Sugar Company, a subsidiary of the Celotex Company, of Chicago, opened a new sugar mill at Clewiston, Fla., on the south shore of Lake Okeechobee. The Clewiston mill is another unit for the production of sugar for the trade and of bagasse for the Celotex Company.

Candy Makers Control Softening of Cream Centers

By H. S. Paine

Carbohydrate Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture

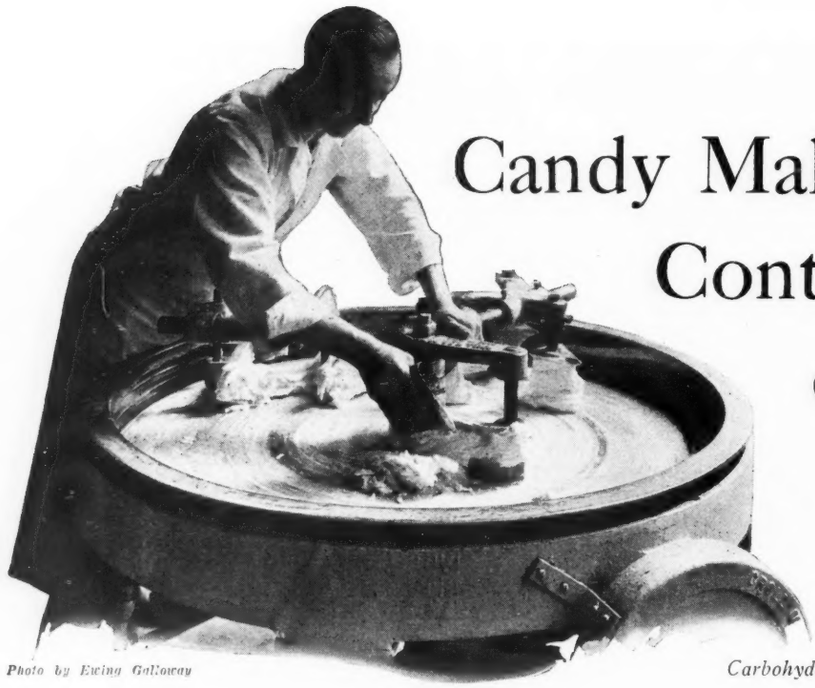


Photo by Ewing Galloway

Mixing cream centers in which the requisite amount of invertase has been incorporated

IN THE manufacture of candy of fondant type, which constitutes a large proportion of the total quantity of candy now manufactured in the United States, it is desirable that the fondant have a rather soft consistency or texture at the time the candy is consumed. For instance, in chocolate-coated creams the fondant center should have an agreeable soft consistency in order to be palatable. In some kinds of candy, it is even desirable that the fondant center be distinctly fluid, and centers of this type are known as "flowing" centers. The production of such fondant centers within the limitations of the usual methods of manufacture has been a difficult and in many cases an impossible task in the past. This will be apparent from a consideration of the method of production, which will now be described in some detail for the benefit of readers who are not familiar with the technic of candy manufacture.

Take as an illustration the familiar chocolate-coated creams. The fondant is heated until it is sufficiently soft to flow and is then delivered into starch molds by an appropriate machine. After remaining in the molds for several hours in order to harden, the cast fondant pieces are removed and cleaned from adhering starch, after which they are coated with chocolate. In large candy factories at the present time the trend is toward mass production and exclusively mechanical means of producing and handling the candy. For instance, the melted fondant is delivered to a depositing machine which makes mold indentations in trays of starch and delivers automatically a suitable quantity of fondant into each of these molds. After these fondant pieces, which are now called "centers," have hardened sufficiently they are removed from the starch and are brushed by a mechanical device to remove adhering starch. The clean fondant centers are conveyed on a belt to an enrobing machine, which mechanically coats them with chocolate. The chocolate-coated pieces then pass through a cooling tunnel and thence to the packing room.

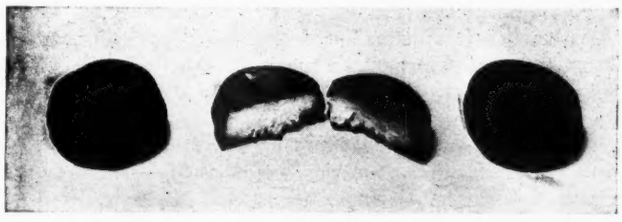
It is evident from this brief description that fondant pieces produced and handled by mechanical means on a large scale must be of rather firm consistency; otherwise they would not stand the mechanical handling. Consequently, if soft fondant centers are to be attained this change in consistency must occur after the fondant pieces are coated with chocolate and the candy has reached a complete stage. Before going into the details of the method of changing the consistency of the fondant, which has been accomplished through the use of the enzyme invertase, and which is now in extensive industrial use, it will be advisable to explain more fully the physical and chemical nature of fondant so that the method of action of invertase will be apparent.

Fondant is usually made from sucrose (cane or beet sugar) and corn sirup. In some cases invert sugar sirup may be used to replace all or a part of the corn sirup. The ingredients in suitable proportion are heated in a steam-jacketed kettle until evaporation of water raises the boiling point usually to a range of 230 deg. to 245 deg. F. The heavy sirup is discharged into a mechanical beater, where it is subjected to rather violent agitation at a temperature of about 90 deg. F. Under these conditions sugar (sucrose) crystallizes from the sirup in the form of minute crystals and the mass assumes an apparently solid consistency. However, it is plastic and is really composed of two portions; specifically, a solid phase consisting of microscopic sucrose crystals and a liquid phase consisting of sirup saturated with sucrose. The consistency of the fondant depends primarily upon the ratio of the sirup or liquid phase to the sucrose crystals or solid phase. Therefore, if the fondant is to be rendered more fluid after being incased in a chocolate coating in the finished candy, the proportion of the sirup phase must be increased in relation to the solid phase. A consideration of this fact suggested to me that this could be accomplished by inverting a portion of the surcose in the liquid phase. The use of acid for this purpose, how-

ever, is not feasible because the amount required would seriously affect the flavor. It occurred to me to use the enzyme invertase,[1] since it can be employed in small proportion without affecting flavor or having any effect other than a specific inverting action upon the dissolved sucrose.

Invertase is added in very small proportions to the fondant at the time it is "melted" prior to depositing in the starch molds. The invertase dissolves in the liquid or sirup phase of the fondant, where it inverts the dissolved sucrose at a rate depending upon certain factors which will be discussed later. As a result of the transformation of some of the dissolved sucrose into invert sugar, the total sugar solubility in the sirup phase is increased; that is, although invert sugar reduces the solubility of sucrose, a given quantity of water is able to hold in solution a greater quantity of a mixture of invert sugar and sucrose than of sucrose alone. Consequently, as the action of invertase proceeds, a portion of the sucrose crystals in the solid phase is dissolved, thus increasing the proportion of liquid phase to solid phase and increasing the softness of the fondant to the point desired.

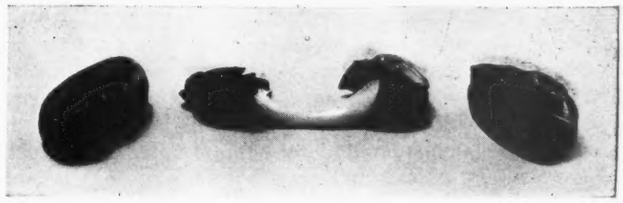
For ordinary purposes it is not desirable to invert all the sucrose in the fondant; therefore precautions must be taken to avoid an excessive degree of inversion. The principal factors in controlling the rate of inversion by invertase are: (1) The time intervening between manufacture and consumption of the candy (the action of invertase proceeds without interruption during the entire period); (2) the temperature to which the candy is exposed during the period intervening between manufacture and consumption; (3) the strength of the invertase preparation; (4) the proportion of invertase preparation added; and (5) the hydrogen ion concentration (pH) of the liquid or sirup phase of the fondant. An invertase preparation of constant and standard activity is therefore



Cream centers before the invertase has softened the fondant

required. Also, because the activity of invertase varies with the hydrogen-ion concentration of the medium, it is desirable, in order that the effect produced may be proportional to the quantity of invertase added, that the pH of the liquid phase of the fondant be kept reasonably constant. This was accomplished by adding to the fondant a definite proportion of citric or tartaric acid, the amount added being ordinarily sufficient to produce a pH reasonably close to the optimum for invertase without adversely affecting flavor.

With a standard invertase preparation available, and the pH of the sirup phase rendered reasonably constant, the remaining requirements were to ascertain the proportions of invertase required for various periods of time intervening between manufacture and consumption of the candy, and to alter these proportions according to the average temperature prevailing during these periods. The required proportions were determined by actual tests representing various typical conditions. Although the temperature to which candy is exposed during the time between manufacture and consumption may vary considerably within 24-hour periods, yet when it is considered that inversion by invertase is a relatively slow action and that several weeks at least usually intervene between manufacture and consumption, a solution of the problem of control from the standpoint of temperature variation is not so difficult as might at first appear to be the case. Satisfactory results were obtained by adjusting the proportion of invertase according to the probable period of time intervening between production and consumption and making a suitable decrease in the proportion of invertase used in summer as compared with winter. When invertase is added to fondant at the time of "melting" preparatory to casting in starch, it is necessary to take precautions that the temperature does not reach



Centers softened to proper consistency by the action of invertase

a point that would inactivate or destroy the invertase. Excessive temperature can be avoided by observing a thermometer control and by using a suitable mixing device to prevent local overheating.

By simply varying the proportion of invertase used it is now possible to attain any desired consistency in fondant candy at the time of consumption. The temperature to which the original sirup batch is cooked can be increased and the cast fondant pieces made as firm as desired with the assurance that by the time the candy is consumed the fondant will have attained the desired degree of softness. Another result is the practical elimination of scrap, which previously resulted from the mechanical handling of cast fondant pieces of too soft a consistency prior to coating with chocolate.

Another advantage of the use of invertase in fondant candy is the possibility of distributing over a long time production for peak periods of consumption. Thus, many large factories now make up Christmas stocks during the summer months. The finished goods are packed and placed in cold storage, where they are kept until required for shipment. If invertase is added in suitable proportion the inversion of some of the sucrose in the liquid phase of the fondant proceeds during the entire period of storage and the manufacturer can operate with absolute assurance that if the necessary precautions are taken the desired consistency will be attained when the candy enters consumption.

Any degree of softening of the fondant center may be obtained, and if desired the fondant may be nearly or completely liquefied and the solid phase of sucrose crystals eliminated. Thus, in so-called "cordial" centers, in which fruits (usually cherries or pineapple pieces) are used, the fruit is imbedded in the fondant center, which is then coated with chocolate. Subsequently, more or less complete liquefaction of the fondant occurs as the result of the action of invertase, and the familiar chocolate-coated liquid centers containing a fruit piece are obtained.

The use of invertase has been applied to fondant coat-

[1]The use of invertase in candy is covered by U. S. public service patent 1,437,816 to H. S. Paine and J. Hamilton.

ing[2] for candy as well as to fondant centers. This procedure is applicable particularly to confections consisting of a fondant center coated with fondant of a somewhat more plastic type. As is well known in the candy industry, such fondant coating dries out very rapidly. The invert sugar produced as a result of the action of invertase retains moisture to a greater extent than sucrose and thus retards drying and prolongs the shelf life of the candy. The general effect of the use of invertase in all fondant candies is to retard aging in so far as the latter is due to evaporation of moisture. This results from the hygroscopic nature of invert sugar; especially of the levulose that it contains. The use of invertase is applicable to all types of candy in which sucrose is present in a solid phase and which contain a liquid phase saturated with sucrose, provided the invertase can be added at a temperature that will not destroy it.

Invertase Useful in Controlling Fermentation

An important advantage of the use of invertase in fondant candies, which developed after its introduction, is the control of fermentation. Chocolate-coated fondant candies, especially those containing a high proportion of sucrose, sometimes undergo fermentation, with the result that gas is produced and the chocolate coating bursts, thus ruining the candy. This is often referred to in the candy industry as "bursting fermentation." Such fermentation has caused a large financial loss in this industry.

My associates and myself have recently investigated this subject.[3] It was found that the most characteristic type of fermentation is due to yeasts of Torula type which are able to grow in a liquid medium of unusually high density. The production of even a small proportion of gas is sufficient to cause bursting of the chocolate coating. In controlling this difficulty fermentation must be checked at the very start. Although these particular yeasts are unusual in their ability to grow in sirup of high density, it appeared probable that there is a definite maximum limit of density beyond which they can not function readily and which might possibly be attained in the sirup phase of fondant. This suggested the idea of increasing the density of the sirup phase in fondant to a point where such yeasts could not grow. Though it was proposed to use also all possible precautions of cleanliness and sterilization, it was evident that it is hardly practicable to render a candy factory sterile from a microbiological standpoint. It was therefore desirable to increase the resistance of the fondant to fermentation (a defensive measure) as well as to take the customary precautions to reduce the attack of the micro-organisms. For obvious reasons the use of a preservative is not feasible.

It is apparent from the solubility and saturation relations of these sugars that the solids content of the liquid phase of fondant is determined primarily by the relative proportions of the sugars sucrose, levulose, and dextrose (the usual sugars of fondant) that are present. Thus, if fondant is prepared from sucrose and water alone, and no material degree of inversion occurs during cooking of the batch, the liquid phase of the fondant would consist of a sirup containing at ordinary temperature about 67 per cent of sucrose. If invert sugar and sucrose are present in the mixture the total sugar solubility in the sirup phase would be increased, and as a result the sirup would have a higher density.

By increasing the proportion of invert sugar it is possible within certain limits to raise the density of the sirup phase as desired. This possibility was investigated by means of experimental lots of fondant which contained varying proportions of sucrose and invert sugar. It was found that the solids content of the sirup phase could be raised to about 80 per cent. These various lots of fondant, containing different proportions of sucrose and invert sugar and having sirup phases of varying solids content, were then formed into candy and coated with chocolate in the customary manner. These lots of candy were then inoculated with yeast which had been isolated from commercial candy that had undergone bursting fermentation. The results obtained were very clean-cut and showed beyond doubt that the extent and vigor of fermentation decreased as the solids content of the sirup phase of the fondant increased. The critical point was at about 79 per cent solids. At this solids content no bursting fermentation occurred even when the candy was strongly inoculated with vigorously growing yeast from cultures obtained from commercial candy that had undergone bursting fermentation.

It was demonstrated that as a general rule fermentation could be controlled by adding invertase to the fondant. The gradual inversion of sucrose present in the sirup phase results in an increase in the solids content and density of the sirup, thus rendering it more resistant to fermentation. This results in what might be termed a race between the yeast and invertase. In a few cases it was found that the multiplication and activity of the yeast increased at a relatively faster rate than the inversion of sucrose by invertase, so that, though the yeast was not able to develop a pronounced degree of fermentation, sufficient gas was produced to burst the chocolate coating of the candy before the density of the sirup was raised out of the danger zone. In such cases an increase in the proportion of invertase used probably would have proved sufficient. In the great majority of cases it was found that the use of invertase prevented bursting fermentation. It is probably safe to say that this is true in fully 90 per cent of all cases of infection.

As a result of these applications invertase is now extensively used in the candy industry in the United States and also in foreign countries, especially in Canada, Australia, and England. Invertase is now being produced in large quantities and has in all probability attained the greatest industrial use of any enzyme in purified form.

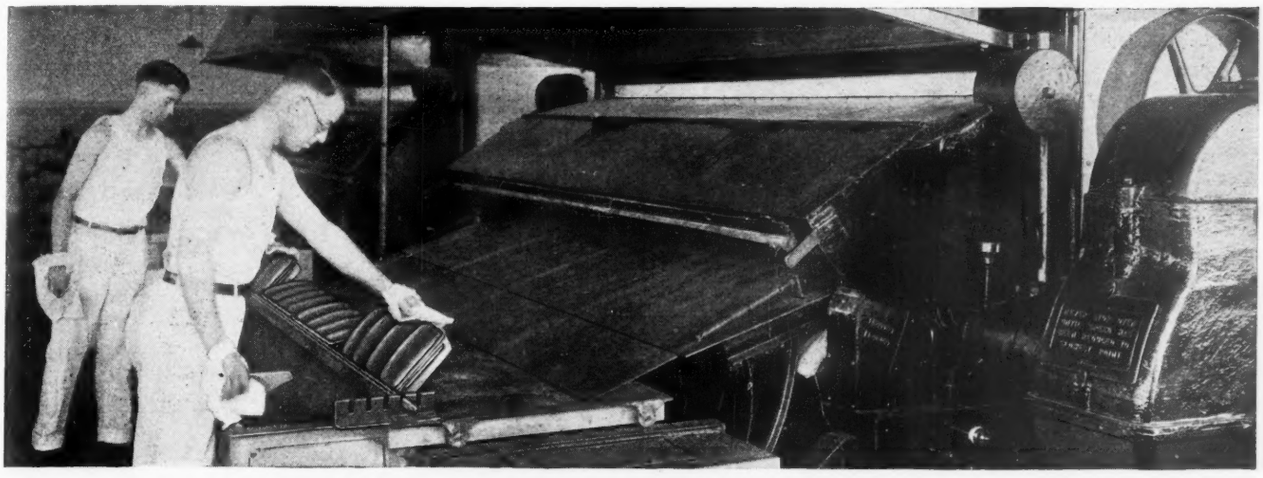
[2]This use of invertase is covered by U. S. public service patent 1,502,207 to H. S. Paine and J. Hamilton.

[3]Church, Paine and Hamilton. *Ind. Eng. Chem.*, *19*, 353 (1927): Paine, Birckner and Hamilton. *Ind. Eng. Chem.*, *19*, 358 (1927).

Peanuts in American Candy

STRIKINGLY rvealed in a trade bulletin issued by the Foodstuffs Division of the Department of Commerce are the extent and importance of the lowly peanut in American industry. Last year the twelve peanut-growing states produced 807,000 tons with a farm value of more than $32,000,000.

While peanut production in this country last year represented an increase over the three preceding years, it was less by half of the average production for the five years before 1922. The popularity of confections containing peanuts is indicated by the steady increase in the consumption by candy manufacturers. In 1927 it is estimated that approximately 100,000 tons of shelled peanuts were so used. Also the United States imports from China considerable quantities of nuts of large size, used chiefly for salting and in confectionery. Last year these imports amounted to nearly 20,000 tons and had a value of more than $1,500,000.



Baked loaves coming through at the rate of 3,000 per hour

Electricity Applied to BREAD BAKING

By Robert Gordon Gould

Assistant Editor

MODERN BREAD-BAKING owes much to relatively recent developments in oven design and construction. The baker of tradition used an internally fired brick chamber that offered about as much in the way of heat control as does the average clam bake of modern times.

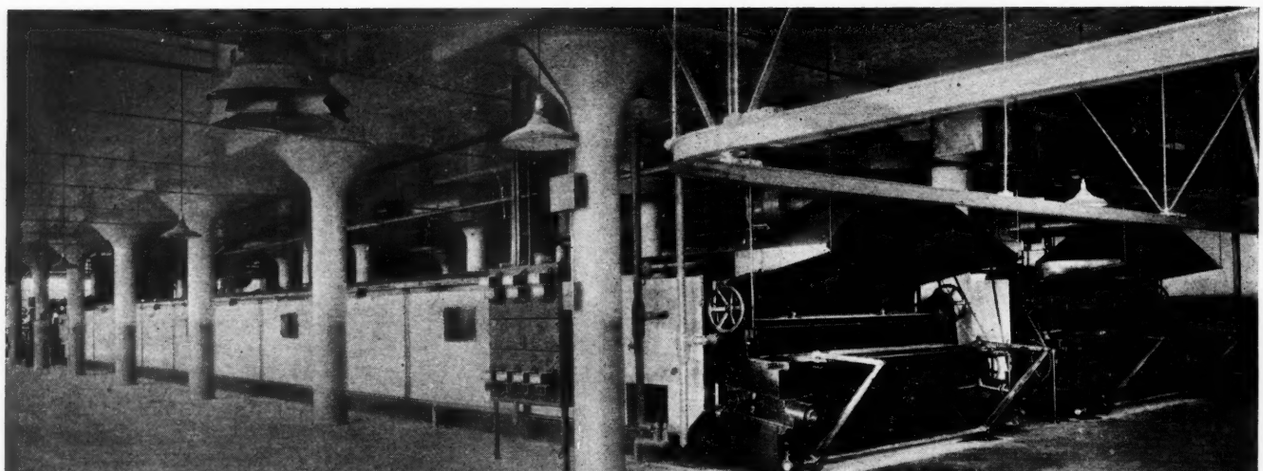
Not until the middle of the nineteenth century was available the peel oven of today, an all-brick, indirectly heated baking chamber in which flues are used to conduct the heat to all exterior surfaces. In that form of oven the fermented doughs, in steel pans strapped together in sets of four, are deftly set on its brick floor through the instrumentality of the baker's peel, or long-handled paddle, reaching from the door of the oven to its back wall, some twelve feet away. The loaves constituting the back row are "in luck," pyrometrically speaking. They go in first; they are farthest from the relatively wide, oft-opened door; they come out last.

At about the turn of the century, the widely recognized need for greater uniformity in the baking of commercial bread led to the development of the draw-plate oven. This was essentially a peel oven to which had been added a movable hearth of steel, on rollers that permitted its being drawn out into the room for loading and unloading, thus obviating the uneven baking of the simpler type of oven. It produced more nearly uniform bread, but was none too popular with the workmen because of its radiation of heat into the room, especially on hot summer nights.

For more than 40 years steam tubes have been used for baking bread. This type of heating, also called water-tube heating, employs some 150 separate tubes, partly filled with liquid and sealed at each end. One end projects well into the fire box, the other into the oven; some of the tubes are placed under the baking floor, others in the upper part of the baking chamber, all tubes being laid at an angle of about two degrees from the horizontal. Many sorts of ovens have been so heated, including the ordinary peel oven, draw plates, rack ovens (those into which whole metal racks of panned bread are introduced for baking), and traveling-plate ovens.

The first traveling-plate oven was used in a Montreal bake shop in 1909. Here for the first time advantage was taken by the bakers of the economies of straight-line production. An endless belt of steel plates traveling through a baking chamber transform fermented dough to baked bread in some half hour's time at the customary bread-baking temperatures ranging from 400 to 550 deg. F. Obviously, with the time of baking a fixed quantity, this type of oven put the whole shop on a relatively inexorable schedule as concerned panning, molding, rounding, and dividing, with their several highly necessary periods of proofing, or fermentative recuperation from the effects of machine work. Also, and equally obviously, the fermenting of the doughs and their mixing were similarly, although more remotely, affected. Like its predecessors, it was constructed of brick, with that material's characteristic weight and its relatively great heat capacity. Measures for specific control of heat were limited to the use of the heat ballast of the walls and were correspondingly slow acting.

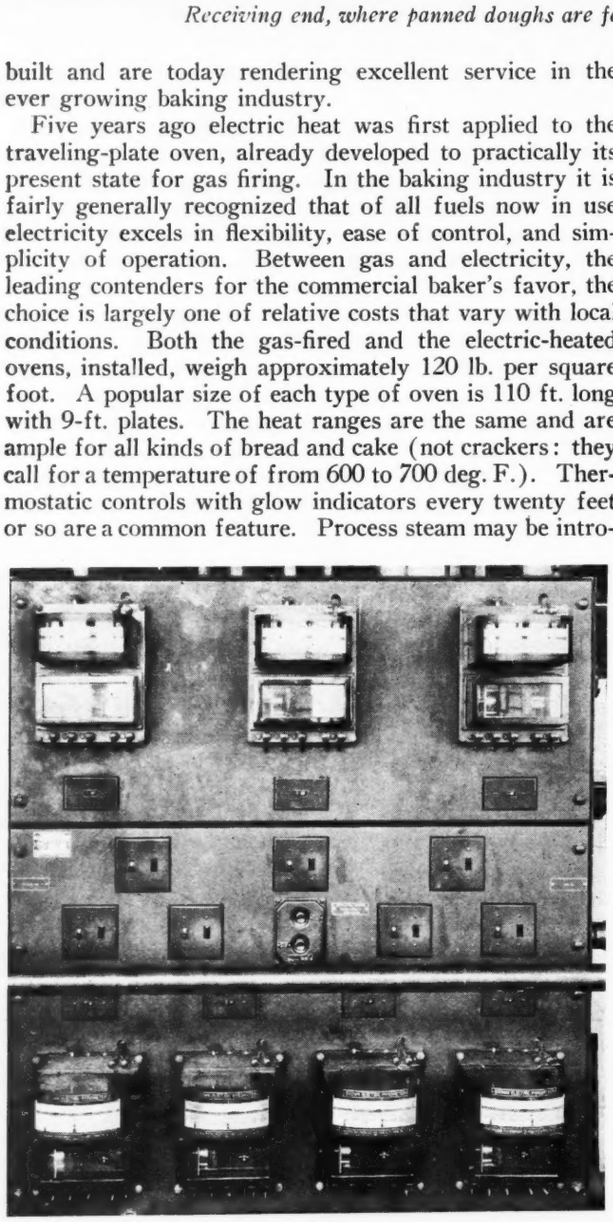
The first traveling oven of insulated sheet metal instead of brick walls came in 1917. It demonstrated that satisfactory heat distribution could be obtained without the use of a relatively great heat ballast. It was heated by gas, a method that permits full specific, or localized, control of heat intensity. Since then many metal-walled, well-insulated, traveling-plate, gas-fired ovens have been



Receiving end, where panned doughs are fed to traveling hearth by automatic pusher bar

built and are today rendering excellent service in the ever growing baking industry.

Five years ago electric heat was first applied to the traveling-plate oven, already developed to practically its present state for gas firing. In the baking industry it is fairly generally recognized that of all fuels now in use electricity excels in flexibility, ease of control, and simplicity of operation. Between gas and electricity, the leading contenders for the commercial baker's favor, the choice is largely one of relative costs that vary with local conditions. Both the gas-fired and the electric-heated ovens, installed, weigh approximately 120 lb. per square foot. A popular size of each type of oven is 110 ft. long with 9-ft. plates. The heat ranges are the same and are ample for all kinds of bread and cake (not crackers: they call for a temperature of from 600 to 700 deg. F.). Thermostatic controls with glow indicators every twenty feet or so are a common feature. Process steam may be introduced in either with equal facility. In short, first quality bread may be baked in either type of oven. So similar are they that representative manufacturers are offering convertible installations for use with either gas or electricity.



Oven control panel, through which General Electric tumbler switches and Brown electric pyrometers furnish seven separate heat controls

Present installations of electrically heated, conveyor type ovens for baking bread and cake aggregate at least 32 the country over. In addition thereto there are numerous electrically heated units handling pastry, doughnuts, or macaroons (macarons)—all products the manufacturing cost margins of which are not so narrow as in the baking of bread, and hence not strictly comparable.

The larger units include two ovens in Seattle, three in Portland, one unit each in Eugene, Ore., San Diego, Calif., and Phoenix, Ariz., and the following named baking establishments:

Name	Location	Number of Ovens
Nasmith, Ltd.	Toronto, Ont., Canada	1
Cushman Baking Company	Lynn, Mass.	1
First National Stores	Summerville, Mass.	2
General Baking Company	Charlestown, Mass.	1
Continental Baking Company	East Hartford, Conn.	1
Raymond Baking Company	Waterbury, Conn.	1
Cortland Baking Company	Cortland, N. Y.	1
General Baking Company	New York, N. Y.	2
General Baking Company	Brooklyn, N. Y.	1
General Baking Company	Jersey City, N. J.	2
Tasty Baking Company	Philadelphia, P	3
American Stores	Philadelphia, Pa.	1
Horn & Hardart	Philadelphia, Pa.	1
Koehler & Fretz	Lansdale, Pa.	1
Huber Baking Company	Wilmington, Del.	1
Manbeck Baking Company	Hagertown, Md.	1
Fisher Brothers	Cleveland, Ohio	1
American Lady Bakery	Salt Lake, Utah	1
Mutual Creamery	Oakland, Calif.	1

The plant of the First National Stores, Inc., at Somerville, Mass., occupies an aggregate of 486,030 sq.ft., of which 62,170 sq.ft. is at present made use of by the bakeshop. Transportation of materials and finished products within the plant is accomplished by a fleet of fourteen Baker storage-battery trucks, supplemented by an electric tram railway with overhead trolley that is used in assembling orders for the 1,800 branch stores served by the home plant. Power for the latter is supplied by a 230-volt motor-generator set, the batteries in the trucks being charged by a charging set installed at the plant.

In addition to baking bread in a bakery with a rated capacity of one million loaves a week in a single eight-hour shift, there is manufactured a line of preserves and condiments, cooked foods, and similar products.

Electric power is obtained from the Edison Electric Illuminating Company, of Boston, over two duplicate

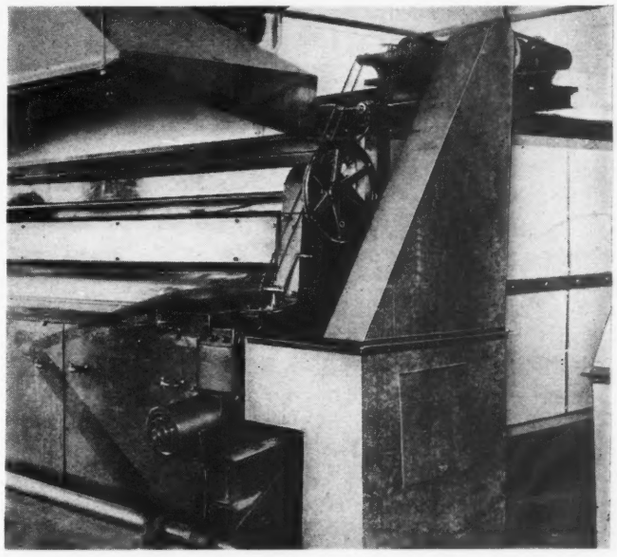
13,800-volt incoming lines. The current is passed through transformers and reduced to 440 volts for three-phase motors and for the General Electric oven-heating units, and to 110 volts for lighting service and for the small single-phase motors on miscellaneous equipment. In addition to the heating devices and the large number of electric motors, there is a complete refrigeration plant, driven by a pair of synchronous motors of 125 horsepower.

All of this has a bearing upon the decision to bake by electricity, because of its establishing in the aggregate a heavy demand for electricity, fairly well balanced as to peak load, and especially favorable from the point of view of the power factor. Because of the relatively great influence of the oven resistance load, with its practical elimination of power lost by magnetization of field coils in motors, the average power load is approximately 0.98. With the ovens shut down, the power factor is about 0.90, a drop kept from being greater by the numerous synchronous motors installed throughout the plant. This is, of course, the best known method of obtaining favorable power rates from a public utility company, which, after all, is the determining factor in connection with all matters electrical.

The bakery of the First National Stores, Inc., is a thoroughly modern, fully mechanized bread-making establishment. Equipment is Baker Perkins throughout, the air conditioning in the fermenting room having been installed by The Cooling and Air Conditioning Company of New York. About the only manual operation still remaining is the time-honored custom of "punching" the doughs.

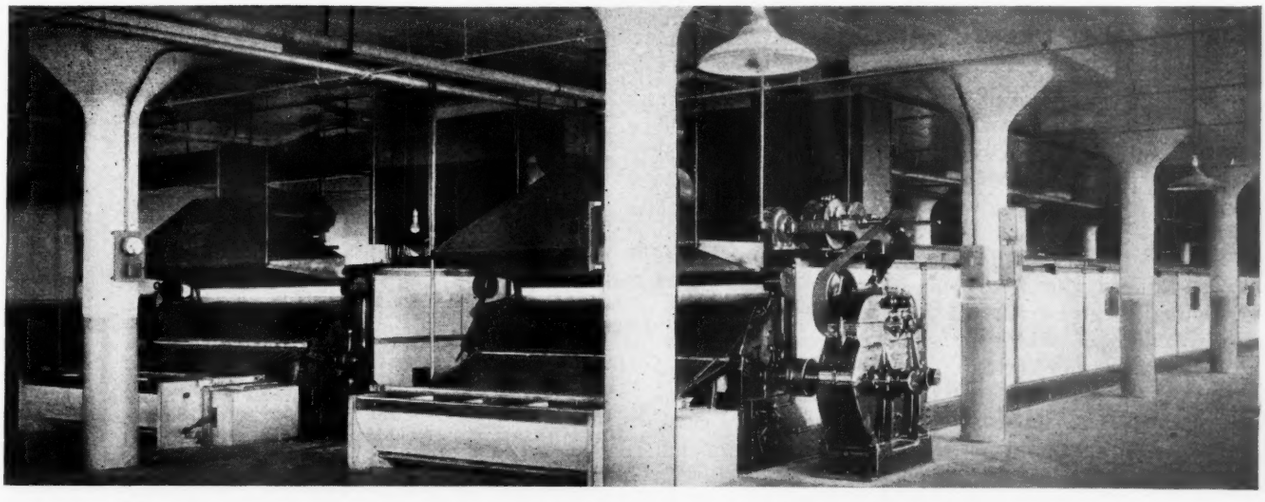
Following the usual bread-making practice from flour-blender to final proofer (which accommodates 10,000 loaves at a time), the panned doughs, in sets of four, which, in turn, fill the several sections of a steel rack, are slid, by trolley wheels traveling on the I-beam shown in the near upper foreground of the accompanying illustration, from the proofing room to the apron of the oven, also clearly discernible. Taken by hand from the racks, they are placed on the apron, eight in line. A motor-driven push bar, clearly shown in the picture, now comes into play and gently slides all eight pans onto the 9-ft. plate of the conveyor oven that is constantly moving at its predetermined speed of approximately 110 ft. every 32 min. At the end of that time the panned doughs emerge at the delivery end of the oven as fully baked bread.

Immediately to the left of the building column is seen the temperature control panel for the nearer of the two ovens. The smaller detailed illustration of this panel shows clearly the five Brown electric pyrometers that control the temperature of the oven. Provision is made for three separate heating sections above the hearth and four alongside (termed bottom heat)—seven in all, giving great flexibility of heat intensity. The resistor-type heating units are brought into play by nothing more complicated than a push button.



Feeding mechanism, showing the motor-driven pusher bar (in silhouette, because of its being in motion) that gently transfers panned doughs from apron to traveling hearth

As might be expected with a panned dough that is presumed to spring considerably in its pan during the process of baking, the bottom is at the outset given greater heat than the top; and, equally obviously, top heat is used to brown the crust of the nearly baked bread. On a typical bread dough of average size (20 oz. baked weight) the first bottom section may be set for 425 deg. F. and the top at 410 deg. F., ending with temperatures of 500 deg. F. bottom heat and 550 deg. F. top heat.



Discharge end, showing driving gear and upper end of chutes leading to traveling cooling conveyor located on the ceiling of the floor below

These control instruments operate at 110 volts. The oven resistance slabs, which are plainly visible through small observation doors set in the side of the oven, operate at 440 volts.

At the delivery end of the oven, the baked bread, still in four-pan sets, is automatically slid down the apron to the receiving and de-panning ledge shown in an accompanying view. After removing all four loaves by a smart rap on the ledge, which action serves to send the loaves into the feeding hopper of the traveling cooling mechanism located immediately beneath the oven, the pans are set aside for an early return to the other end of the shop. At the end of the oven is seen the covered mechanism for operating the conveyor hearth of the oven. This is a cut gear operated by a 7.5-hp. motor. There is a 5-hp. exhaust fan for cooling purposes.

Foreign Trade in Pickles and Condiments

IN 1927, the United States foreign trade in pickles, sauces, and relishes amounted to 27,994,572 lb. valued at $3,188,958, an increase in volume of 4,769,270 lb., and in value of $472,331, over the 1926 figures. The volume of trade in 1927 was divided almost evenly between exports and imports, the respective percentages being 50.8 and 49.2, as compared with 44.6 and 55.4 per cent, respectively, in 1926. The value of this trade in 1927 was not so evenly divided as the volume. Exports were credited with 64.5 per cent of the total value of the trade in 1927, leaving only 35.5 per cent for imports.

Outlook for the Trade

In the opinion of James R. Scully, of the U. S. Department of Commerce, radical changes in the volume or trends of trade in pickles, sauces, and relishes in the near future are not expected. Purchases by certain Latin American countries will probably continue to show some increase. In the Orient, the market for these products is expected to continue normal, since they are consumed principally by Europeans, whose earning power is sufficiently large and generally constant to insure continued sales. Greater competition may be looked for in Canada from the domestic industry and from branch factories of British firms. In South Africa, competitive prices will help the sale of American pickles and condimental sauces; also increased exports to that area may be anticipated when changes in modes of living have built up a larger consumer demand for such foodstuffs. In practically all of the countries of Continental Europe, condimental sauces of American manufacture are often considered a luxury by local consumers, on account of their price.

The market for such products in many of those countries is consequently restricted to foreigners and to hotels and restaurants catering to tourists. The possibilities of the United Kingdom market, however, are far from exhausted. Sales of pickles to that market may continue to be unimportant, but increased business in ketchup and tomato sauces may be expected to parallel the rapid growth of popularity of these products in the British household. Exports of other condimental sauces and relishes to the United Kingdom will probably show a slow but steady improvement as their qualities become more generally recognized.

The following tables show the United States foreign trade in pickles, ketchup, tomato sauce, other sauces and relishes by countries of origin and of destination for the three-year period 1925 to 1927, inclusive.

Exports of Pickles, Ketchup, Tomato Sauces, Other Sauces and Relishes from the United States, 1927

Product and Country of Destination	1925	1926	1927	
Pickles	Pounds	Pounds	Pounds	Dollars
Canada	551,132	545,050	1,698,720	54,740
Cuba	667,922	496,037	676,944	25,658
Philippine Islands	190,044	184,748	387,425	53,305
Australia	88,761	130,434	130,361	25,656
Panama	62,430	69,712	77,395	11,007
China	77,069	67,969	51,088	11,237
British South Africa	63,026	39,018	46,115	7,660
Mexico	77,661	64,003	43,076	6,412
Venezuela	18,529	31,356	37,191	6,586
Colombia	27,178	35,959	33,046	7,101
Others	305,082	274,142	271,638	54,396
Totals	2,128,834	1,938,428	3,452,999	263,758

Ketchup and Other Tomato Sauces	1925	1926	1927	
	Pounds	Pounds	Pounds	Dollars
United Kingdom	2,753,460	2,998,123	4,887,925	770,424
Philippine Islands	360,704	471,192	395,292	38,925
Japan	175,608	238,667	238,865	41,870
China	211,445	193,989	235,260	39,854
Panama	219,334	193,160	229,556	23,117
Mexico	236,547	295,280	214,278	28,086
Cuba	157,178	122,501	163,217	18,852
British India	95,451	115,991	110,366	27,019
British South Africa	67,081	75,413	74,145	19,309
Colombia	54,787	68,450	67,669	11,901
Dominican Republic	15,901	15,747	67,104	6,394
Others	972,450	1,033,574	1,111,661	157,437
Totals	5,319,946	5,822,087	7,795,338	1,183,188

Relishes Other Sauces and	1925	1926	1927	
	Pounds	Pounds	Pounds	Dollars
Canada	813,102	897,113	1,321,079	193,708
Mexico	307,969	269,129	223,464	43,030
United Kingdom	153,569	126,838	146,589	35,955
Panama	128,281	147,554	138,547	31,298
Venezuela	60,016	87,808	101,282	26,360
Philippine Islands	160,558	83,722	95,735	22,993
Australia	117,921	102,885	92,839	34,615
Cuba	181,886	111,866	88,128	16,650
Java and Madura	36,961	55,585	64,712	8,636
British India	55,488	59,866	62,494	26,214
Others	653,931	643,061	632,127	169,031
Totals	2,669,702	2,585,527	2,968,996	608,490

Imports of Pickles and Sauces into the United States

Product and Source	1925	1926	1927	
Pickles	Pounds	Pounds	Pounds	Dollars
United Kingdom	289,854	314,617	628,091	149,911
Canada	557,513	813,287	298,416	7,024
Netherlands	47,950	180,570	105,565	8,136
Italy	171,676	188,731	103,304	6,630
Japan	19,062	16,594	33,347	3,811
Others	859,586	82,917	37,921	4,506
Total pickles	1,945,641	1,596,716	1,206,644	180,018
Sauces				
Japan	7,280,860	7,381,048	7,805,343	468,234
Hong Kong	2,273,269	1,681,529	2,937,832	195,266
Italy	316,034	135,259	733,350	69,682
France	386,460	335,558	369,883	71,300
United Kingdom	346,378	319,534	253,716	69,982
China	282,648	1,236,550	173,814	9,541
British India	19,209	9,488	114,656	27,824
Others	177,785	183,578	182,001	41,675
Total sauces	11,082,643	11,282,544	12,570,595	953,504

Sugar—*the Master-Preserver*

By Stroud Jordan
Chief Chemist, Henry Heide, Incorporated

The part that sugar plays in the preservation of many foods of varying dietary functions described by Dr. Jordan briefly but comprehensively

THE ART of food preservation is a direct result of man's necessity. Certain seasons yield an abundant harvest, whereas others are barren, and if want and starvation are to be avoided, foods must be preserved when they are to be had in abundance. Fruits were early found to remain in good condition when dried in the sun, but, if stored as nature produced them, fermentation set in, and the result was either a total loss or the formation of alcoholic compounds that are now in legal disfavor. Thus we have the genesis of fruit preservation, and to this crude beginning our present-day sweets owe their origin.

In desiccating fruit products the solids-to-water ratio is changed, preventing fermentation and the action of destructive bacteria. The cause of this effect is directly traceable to the preservative action of sugars, and this action will vary with the solubility in water of the individual sugar. Early practice was to take a fruit, squeeze out the juice from one portion, and boil it down to a thick syrup; then to add another portion of fresh fruit and again boil for a sufficient length of time to sterilize the whole batch. This crude method is still in use in some countries and makes possible the preservation of a winter's supply of sweets which would otherwise be impossible. Modern methods of purifying sucrose and other sugars have made it possible to preserve fruits in a more natural state, but with their adoption other complications have arisen.

Relative Solubilities of Various Sugars Are of Importance

In the production, marketing, and sale of confectionery, as with other food products, sucrose is the most important of all compounds, on account of its preserving action. Its solubility is a prime factor, and where one must produce sweets that are soft and still low enough in moisture to withstand the ravages of an air filled with yeast and molds, its use must be supplemented by more soluble sugar mixtures. At ordinary atmospheric temperatures, sucrose has a solubility in water that rarely exceeds 67 per cent, whereas invert sugar (an equal mixture of dextrose and levulose) will dissolve up to 85 per cent.

The higher solubility of invert sugar is not permanent. Dextrose, because of its lower solubility, will separate out after long standing or when subjected to low temperatures. To offset such a condition a two-to-one mixture of invert and sucrose is used, which prevents much of the tendency of the dextrose to crystallize. A mixture of sucrose, dextrose, and levulose acts in a very different manner from the mixture of dextrose and levulose alone.

In the manufacture of fondants, or other sugar confections composed of a majority of sugars, the proper sugar ratios must be maintained or an enzyme of the invertase type added in order to produce invert sugar from the sucrose that is present. One of the greatest steps forward in the production of quality confections has been the direct outcome of proper sugar use and the utilization of the enzyme invertase to bring about the proper ripening and preserving action in the goods itself.

The proper combination of sugars will produce a product that will keep under average conditions, but it is not reasonable to suppose that such a product may be left lying around in any sort of temperature and humidity. Some confections will keep in containers that allow for the breathing off of excess moisture; others must be closed tight to prevent loss or absorption of moisture, but nuts, and confections using them, require different treatment. They must be kept away from the air if the manufacturer or confectioner would prevent oxidation of the oils they contain and the subsequent rancidity that always accompanies such action. Then, too, a loose-fitting top on a container invites insect breeding and causes loss from worms, which are thus hatched out in the product.

Possible Oxidation of Packaged Foods Best Guarded Against by Vacuumizing

Containers of the vacuum type, or those that have been vacuumized and then filled with an inert gas and sealed, are the best sort for all exposed nut products. Rancidity will also take its toll from milk and dairy products, when they are used, unless packaging is done properly. Still another factor in the preservation of chocolate goods, which is apparent to those familiar with their manufacture and handling, is the temperature of storage and handling. These products must never be subjected to a temperature at which cocoa butter melts, or to one close to such a point, if graying is to be prevented.

And so the preservation of sweets grows apace, with sugar playing the title rôle of preservative. From sugar-cured hams and bacon to the most delicate tidbit of an artistic confectioner it will be found playing its part, and its use is as necessary in the human diet as it is in the rôle of nature's preservative. The proper use of sugars will eliminate many apparent needs for non-food preservatives, and yeast and molds will cease to grow where its concentration is sufficiently high.

Critically correct concentration of sugar in a product, and its proper handling thereafter, will cut the waste bill of the confectioner many times, but where no care is given to the sugar percentage or the method of handling after the goods are made, rebate checks will continue to be written, and waste cans will still have to be regarded as regular equipment.

The Fishing Industry . . .

Discovers How

SMOKE Preserves

By Ernest Hess

Bacteriologist, Fisheries Experimental Station, (Atlantic), Biological Board of Canada, Halifax, N. S.

Photographs by Ewing Galloway

Canadian Grand Banks fisherman "Blue Nose" forging ahead of the American "Henry Ford"

ALTHOUGH smoking is one of the oldest methods of fish preservation, scientific investigation of the problems confronting this industry have been started only in recent years. In the United States and Canada smoke curing does not play as important a rôle as it does in countries like Scotland and Germany, and yet the smoking industry has stood its ground in spite of the introduction of new preserving methods in the form of canning and freezing. Production of smoked fish in the United States was more than doubled in value from 1914 to 1919; in Canada the same is true between 1923 and 1926. The present value of smoked products amounts to about $2,000,000 for Canada and about $5,000,000 for the United States. The principal fish preserved by smoking are the haddock, cod, herring, and salmon, depending on the locality; but a much greater number are smoked on a smaller scale, including: mackerel, halibut, alewives, hake, cusk, pollock, black, ling, and red cod. Almost always cod are smoked as fillets, haddock as fillets and to a large extent as finnan haddies, herring as "hard herring," or as "bloaters" or "kippers." Many fish, such as salmon and finnan haddies, are also smoked previous to canning.

Before the days of cold storage, improvement of the keeping quality of the fish was the main purpose of smoking. Fish flesh is a perishable food. Immediately after death the muscle substances begin to undergo changes, through the action of digestive juices, the so-called enzymes, which are present in the muscles themselves. These changes, called autolysis or self-digestion, produce an unpleasant flavor and odor. (In the ripening of meat, a certain degree of autolysis is desirable.) Autolysis, which is accelerated by increasing temperature, is soon overtaken by the action of bacteria, which invariably gain access to the fish muscle, mainly from the surface slime of the fish and from the alimentary canal, where they occur in immense numbers. For example, 1 gram of slime from a cod or salmon may contain from 700,000,000 to 4,000,000,000 bacteria, when the fish is out of the water from 12 to 24 hours.

Bacterial decomposition of the fish muscle takes place at a much faster rate than the initial autolytic changes. It is mainly in order to inhibit, or at least retard, this spoiling action of the bacteria, that methods such as salting, drying, canning, freezing, and smoking are used. In our endeavors to preserve fish for future consumption, smoke is utilized as a chemical disinfectant; that is, a substance which, if used in sufficient concentration and for a sufficient length of time, will inhibit bacterial growth and action and even kill the bacteria.

Fish that are smoked long enough to obtain this improved keeping quality will have acquired a brown color and a more or less smoky flavor. Though this method of smoking is still in use as so-called "hard smoking" ("hard herring" are smoked for several weeks), there has been a decided preference in late years for a milder form of smoke curing, which may agree better with our modern delicate palates and stomachs. In "mild smoking" (fillets especially) a light smoky flavor only is de-

sired, and has become the main purpose of the curing. Such a fish, which is smoked for comparatively a short time, does not acquire color nor keeping quality enough by the smoking alone. These defects are remedied, however, by the use of artificial coloring and by cold storage.

Methods of Smoking Fish*

For a better understanding of the following paragraphs it seems advisable to mention briefly the commercial methods in present use, taking one form only, the smoked fillet, as an example—fillets being the two fleshy sides of the fish that remain after the head, fins, bones, and skin have been removed. Fillets are first immersed in strong salt brine (90 per cent saturated) for from 20 to 30 minutes. The exact time depends upon the size and condition of the fish and upon the season. Artificial coloring is added to the brine in the form of a harmless vegetable dye. The fillets are removed from the pickling vats by means of dip nets and are hung over long double iron rods, to drain. On these rods (tenters, by name) they are hung in the smoke house, where they are first dried rapidly—that is, in two and a half to three hours. For this purpose clear fires of hardwood are lighted on the ground, and the smoke house is kept well ventilated. After drying the fish, the fires are partly smothered with sawdust in order to produce a dense smoke, which is kept passing up through the mass of fish until the desired cure is attained.

Fillets can be cured in four to five hours, if artificially colored. The total period from the beginning of the pickling to the end of the smoking is therefore from seven to nine hours, whereas the same process for the smoking of finnan haddies would require from thirteen to seventeen hours. After the fillets have been allowed to cool they are removed from the rods, trimmed, wrapped, and packed in boxes. If not intended for immediate consumption, they are usually chilled or frozen.

The quality of the finished product will depend upon the following factors: freshness of the fish, method of filleting and cleaning, quality of the brine and time of brining, drying, quality of the smoke and time of smoking, and the method of handling the smoked product.

Principles of Smoke-Curing Fish

Pickling—The strong salt brine in which the fish are immersed acts in several ways. One effect is the inhibiting action of the nearly saturated salt solution upon the spoilage bacteria. Most marine bacteria prefer salt concentrations of from 1 to 2 per cent and are, with few exceptions, inhibited by 5 per cent of salt and higher. It is the dehydrating action of the salt, depriving the bacteria of the water without which they cannot live, that accounts for the preserving action of strong pickles.

The purer the salt (mined salt is usually superior to solar salt), the quicker it will penetrate the fish and reach the center, in the race against the spoiling action of the bacteria.

Also, the concentration of the pickle has been found to have a decided influence upon the production of the surface of the finished product, a very important factor from the buyer's point of view. A smooth surface with a sheen is desired, and can best be obtained by using 50 to 60 per cent saturated pickle, nearly saturated pickle giving a dull, rough surface; brining for 35 to 50 minutes at the lowest possible temperature; and washing the fish in fresh water after brining. (Dreyer, Forbes.)

A small amount of fish muscle protein is dissolved and lost into the brine during pickling. In saturated brine a considerable loss of volume, though but little change in weight, takes place, the loss of water, which is extracted from the fish by the salt through osmosis, being partly counteracted by the absorption of salt. In half-saturated brine an increase in weight as well as volume takes place. (Weld.) In addition, pickling gives to the fish a pleasant salty flavor.

Drying—The purpose of the initial rapid drying of the fish is the formation of a pellicle, or hardened surface layer. Warm air is passed quickly over the surface of the fish and dries the outer layer, a well-ventilated smoke house carrying off the surface moisture. The fire, besides helping to circulate the air, warms the smoke house to between 80 and 90 deg. F. This temperature is sufficiently high to coagulate some of the fish proteins on the surface, which leads to the pellicle formation. This pellicle retains much of the moisture in the inner parts of the fish, a desirable thing for marketing and, furthermore, essential to the production of the sheen on the surface of the smoked finished product. Fish that are smoked first and dried afterward will not acquire the sheen. The best surface is obtained when the fish are dried rapidly. (Dreyer, Forbes, Weld.)

In order to carry off the moisture from the fish in the shortest possible time, the circulating air in the smoke house must be dry and warm. Unfortunately, atmospheric conditions are very often adverse to these requirements (on warm, damp summer days, for example) and have hitherto been one of the least controllable factors in smoking, thus making extremely difficult the production of a standard quality article throughout the season. The

Alongside the wharf where supplies are taken aboard

*For general information on fish-smoking methods, see: Tressler, *Marine Products of Commerce*, Chap. 18.

Not all sentiment has left the industry. This is the "Annie & Mary."

modern trend in smoking has been, therefore, to use for circulation and recirculation through the smoke house conditioned air of automatically controlled moisture content and temperature.

Production and Chemistry of Woodsmoke

Smoking—For fish curing, smoke is produced by means of smoldering sawdust, preferably from hardwood. The products of combustion depend on the air supply and the temperature of combustion. Although a fairly complete list of substances produced in the destructive distillation of wood has been established, knowledge of the exact chemical constitution of woodsmoke is still very limited. Smoke production seems to be a process between the burning of wood where in the presence of an adequate air supply the combustion products are almost completely burned, with little smoke production, and the destructive distillation of wood in the absence of air. In smoke are found not only the compounds of wood distillation, but also substances that result from the partial or complete oxidation of these compounds; for example, the methyl alcohol formed in wood distillation in the absence of air is oxidized in the smoke production to formaldehyde. (Dauphinee.)

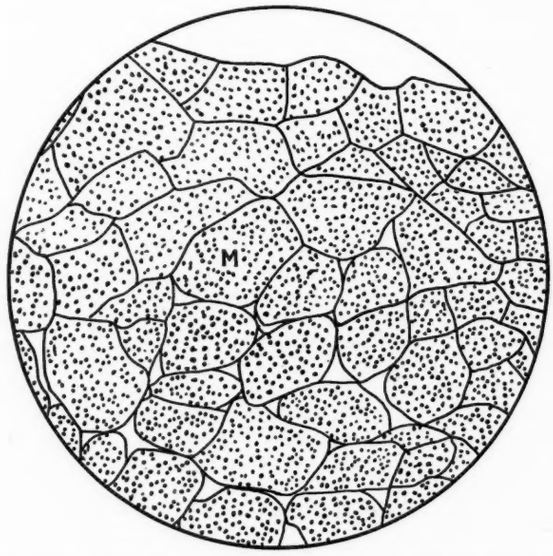
Wood smoke contains a number of aldehydes, especially formaldehyde and acetaldehyde, besides acetic acid. (Cooper.) Formaldehyde has not only been proved to be present in smoke, but also in a variety of smoked products such as herring ("bloaters" and in large amounts in "kippers"), raw smoked ham and bacon, and other similar products. With increasing air supply the smoke not only becomes denser, but its formaldehyde content is increased also, and at the same time its bactericidal action. (Dauphinee, Hess.)

The only control over the smoke production in the old-fashioned smoke house has been that of the air supply by ventilation. Little control over the humidity and temperature of the circulating smoke was possible. Modern methods tend toward a more and more completely automatic control of the combustion of the sawdust. A measured amount of conditioned air is supplied to an electric furnace, in which the smoke is produced by burning sawdust at a controlled temperature. From the furnace the smoke is blown at a definite rate directly into the smoke house.

Strengthening of the Connective Tissues—Formaldehyde has long been known to exert a peculiar effect upon gelatin, which if treated with it will not melt on subsequent heating, even after prolonged boiling. Smoke, also, has the same action upon gelatin. If fish muscle is treated with either smoke or formaldehyde, its tensile strength is increased, which means that it cannot be torn apart as easily as can fresh muscle. This is due to the hardening of the connective tissues, which holds the muscle myomeres together. The action is similar to that of the hardening of gelatin under the same treatment, and reminds us that gelatin is closely related to animal connective tissue. (Forbes.)

If the smoke house is allowed to become too warm, the fish often drop from the tenters, becoming a loss. Here the connective tissue has been weakened by the moist heat before the smoke was able to exert its strengthening action. Smoke makes the fish firmer and easier to handle, and counteracts the weakening action of the heat on the tensile strength. The tensile strength of the fish muscle is greatly increased by treatment of the fish with sodium chloride in the form of salt brine applied previous to smoking. (Forbes.)

Coloring—When smoked fish are removed from the smoke house their color deepens on exposure to air, the coloring substance being oxidized. The same is true of fresh fish, treated with smoke distillate. Any suitable alkaline substance (sodium bicarbonate, for example) will quicken this darkening action, as well as the coloring of the fish during smoking. Well-dried fish will color more quickly than will wet fish during smoking. Comparison of smoke distillate with a number of polyphenol derivatives seems to point to the possibility that the coloring matter of smoke is one of these substances,



Cross section through fresh fish, *showing muscle fibres (M). Drawn from a photomicrograph (Weld).*

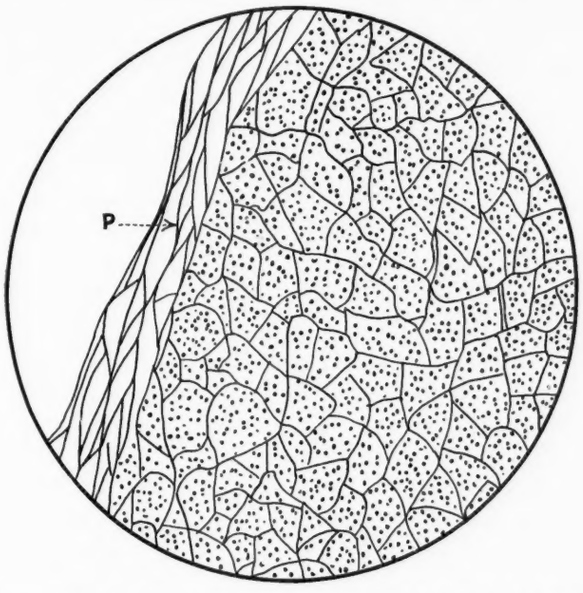
or some condensation product of formaldehyde and a polyphenol derivative. (Forbes.)

Whether the coloring substance has any other effect on the fish is not certain; on the whole it merely enhances the appearance of the smoked product and thus makes it more salable. Artificial coloring is obtained by the use of a vegetable dye (carotin) or a harmless aniline dye.

Flavoring—Fish that are treated with formaldehyde vapors without being smoked closely resemble in their flavor ordinary smoked fish. Whether formaldehyde alone, or its combination with other strongly flavored constituents of smoke, like phenols, cresols, acetic acid,

and others, are responsible for the peculiar smoky flavor of the smoked product is uncertain. Smoke from softwood sawdust gives a bitter flavor to the fish produced by the resins such woods contain.

Disinfectant Action—For many years formaldehyde has been used as a fumigating agent to kill bacteria in sickrooms and other infected places. It is, no doubt, the main bactericidal constituent of smoke from sawdust. Formaldehyde vapor of the same density as that of smoke has a bactericidal action similar to that of smoke itself. Under similar conditions, smoke from different kinds of sawdust has practically the same bactericidal action. The bactericidal action of smoke is increased with increasing amounts of air supplied to the smoldering



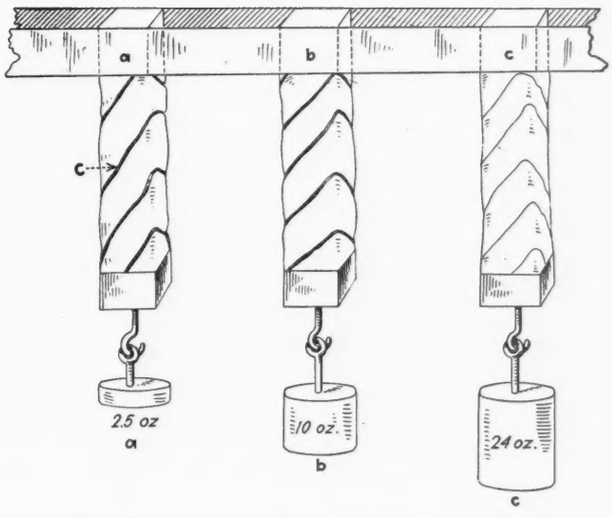
Cross section through smoked fish, *showing pellicle formation (P) on the surface.*
Drawn from a photomicrograph (Weld).

sawdust, the smoke becoming more opaque and concentrated. (Hess.)

Previous treatment of the fish with strong brine weakens the bacteria and renders them less resistant toward the smoke. The same effect is obtained if the bacteria are in acid surroundings. This happens naturally when the acetic acid of the smoke is deposited on the fish during smoking; however, the fish proteins act to some extent as buffers. The proteins also exert a "quenching" action upon the smoke, by partly combining with smoke constituents and making them ineffective. Protein-derivatives have more quenching action than the native proteins, especially in the case of less concentrated smoke. (Hess.)

The bactericidal action of the smoke increases with the length of exposure of the bacteria. In surface exposure the vegetative forms are killed in from one to two hours, depending on the smoke concentration; but bacterial spores, especially old ones, can resist seven hours of heavy smoking with but little loss. (Hess.)

Smoke does not easily penetrate through solid media; therefore the thinner the pieces of fish the more effective the smoking. The disinfectant smoke constituents penetrate from the surface by osmosis, and their effectiveness increases in proportion to their solubility in water. The action of bactericidal smoke constituents is not finished with the termination of the smoking process, the sub-

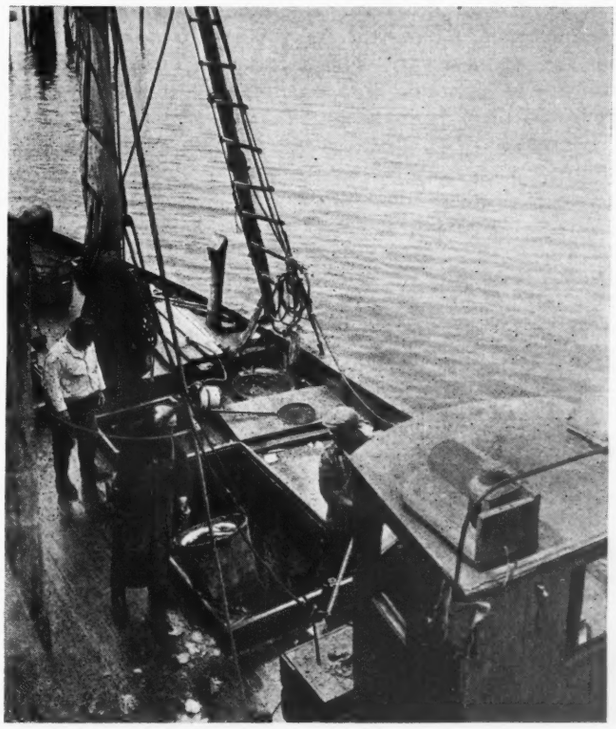


Heated 30 min. 95 deg. F. | *Fresh* | *In saturated brine 30 min. Smoked 2 hours*

Tensile strength is the breaking strain in ounces. Connective tissue C: weakened in a, strengthened in c.
a, b, c, are strips of fish muscle, of a cross-sectional area $\frac{1}{2}$ *in.* x $\frac{5}{8}$ *in.*

stances that have been deposited on the fish during the smoking continuing to act for some time. The larger the amount of disinfectant smoke constituents that have been deposited (by circulating a large volume of newly produced smoke over the surface of the fish), the more effective is the disinfectant action. (Hess.)

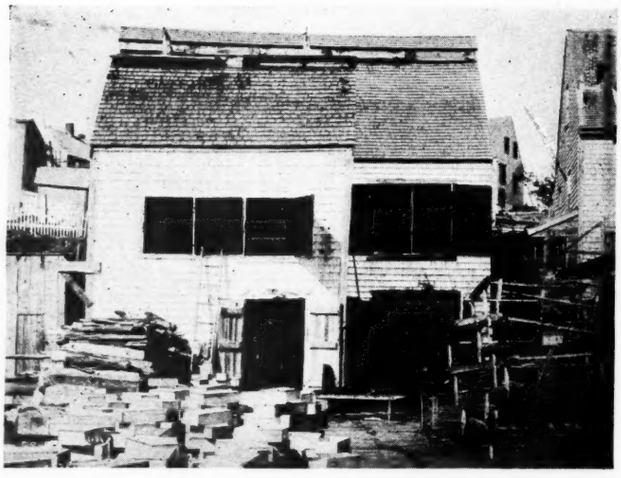
Fresh and freshly smoked fish consist almost entirely of native proteins (mainly albumin), proteoses and peptones being absent. After the second day at ordinary temperature, proteoses being to appear, and after the sixth day the peptones. Amino nitrogen increases in a



Unloading mackerel from a Gloucester fisherman

few days by 50 per cent. Though the changes in the first few days are slight, the fish deteriorate rapidly thereafter. (Dreyer.) Light salted and mild smoked fish, like kippers, keep only two to three days at ordinary temperature; bloaters keep three to seven days, as they are heavy salted; heavy smoked fish keep correspondingly longer. Fish treated with formaldehyde vapors keep for more than a week without any sign of putrefaction, whereas fresh fish become unfit for consumption in three to four days if they are kept at an ordinary temperature.

To improve the keeping quality of mild-smoked fish they are either chilled or frozen, and held in cold storage.



Typical herring smokehouse of the pre-scientific era

Hard-smoked fish (as well as formaldehyde-treated ones), although resistant to bacterial spoilage, are often attacked by molds, which undoubtedly are favored by the acid reaction of the smoke deposits.

This account is based on work carried out at the Fisheries Experimental Station under the direction of Dr. A. G. Huntsman, by Drs. N. B. Dreyer, J. C. Forbes, A. M. Wynne, and Messrs. J. A. Dauphinee, D. leB. Cooper, C. B. Weld, and Ernest Hess, to all of whom the author is greatly indebted. Acknowledgment must also be made to Dr. A. H. Leim and Mr. R. F. Eagar for their valued co-operation in a critical reading of the manuscript.

Developing Salad Oil for the American Palate

By David Wesson

Technical Director,
Southern Cotton Oil Company

MY FIRST recollection of salad oils was the preparation of salad at Sunday dinner. It was really an occasion. My father made the dressing by emulsifying the oil with the yolks of hard-boiled eggs, mustard, and vinegar. The oil came in Florence flasks, with round bottoms, encased in straw baskets, which prevented them from upsetting. It was pure olive oil, I believe. How good it was I do not know; but according to my remembrance it would be called rancid by present day standards.

When I was about ten years old I used to obtain samples of raw peanuts in my father's office. He sold them to people in Providence who, I was told, pressed them and mixed them with oil pressed from cottonseed. This idea proved very unappetizing. Some years later I purchased a small bottle of sweet oil to use on my oil stone and to keep my skates from rusting. It had a foreign label on it, but from the odor, which still lingers quite clearly in my memory, it must have been cottonseed oil.

I did not really become acquainted with cottonseed oil until 1884, when I met it in quantities in the lard refinery of N. K. Fairbanks & Company, in Chicago, where I had started on my first job. When carefully refined from choice crude it made a very good mayonnaise, but had a cottonseed flavor. I used it in my home and gave it to my friends, and so little did anyone know about vegetable oils that my friends could not tell it from olive oil. This is not to be wondered at because the chemistry of vegetable oils was in its earliest infancy and the general public was very ignorant of their properties.

In 1885 Professor Charles E. Munroe published a paper on cottonseed oil for food and medicinal purposes. It gave a good picture of the salad oil condition at that time. He used the Maumemé test, which consisted in measuring the heat evolved by mixing a definite weight of oil with a carefully measured quantity of strong sulphuric acid. Olive oils gave a temperature rise of 36 to 38 degrees, while cottonseed oils gave a rise of 52 to 53 degrees and in about half the time.

Eleven samples, bought at random on the market in foreign looking bottles with foreign labels, were tested alongside of three samples of cottonseed oil. The results showed that 45 to 46 per cent of the samples reacted the same as cottonseed oil. Is it to be wondered at that people could not distinguish between olive oil and cottonseed oil, and that salads were not very popular in this country at that time?

In 1887 the American Cotton Oil Trust was formed. A committee of oil refiners was sent around to visit the different oil refineries and report on the best method of refining crude cottonseed oil. The committee, consisting of four members, two of whom were chemists, visited plants at New Orleans, Memphis, Cincinnati, St. Louis, Chicago, Providence, and Philadelphia.

Winter oil was being made in very large quantities at Cincinnati and Providence, and comparatively small amounts at Philadelphia and St. Louis. It was at Providence that the Union Oil Company made their pure salad and their olive flavored brands. The summer yellow oil was chilled in barrels or trollies in chill rooms, kept at about 40 deg. F. The granulated mash was scooped out

into press cloths, and the bags, or "puddings," as they were called, placed between the plates of a so-called lard presser in a chilled room. This removed the stearine, and the resulting winter oil was pumped to large shallow settling tanks, heated by steam coils. These tanks were in a room with southern exposure and the whole side of the building was of glass, the oil having the benefit of direct sunlight and heat. The result was a pale-colored oil with an olive flavor—that is, a flavor like rancid olive oil. About half the oil sold in this country for many years was of this character, and consequently a strong dislike for salad oils was only natural.

About 1888 the Kentucky refinery at Louisville put out a very fine grade of salad oil. The crude was carefully selected and refined. The oil, after chilling, was strained through long bags looking like stockings, suspended from troughs, through which the oil flowed to fill them. The strained oil was carefully filtered and had a sweet, natural cottonseed flavor.

In 1900 the first Wesson salad oil was made. It was considered needful to give it an olive oil flavor and for this purpose 10 to 15 per cent of a fruity olive oil was added. Although the mixture at first had a pleasant flavor it did not keep well, and after a year or two of experience it was found a great mistake to spoil good cottonseed oil with olive oil. Ever since, all oil sold under the Wesson brand has been cottonseed pure and simple, with the accent on the *pure*.

The pure food law has practically done away with the adulteration of olive oil in this country. The large influx of immigrants from southern Europe has created a demand for salad oils which never before existed, and the possibility of obtaining pure, tasteless, odorless oils, suitable for mayonnaise, has educated the American public to a fondness for salads which, thanks to the efforts of the manufacturers of mayonnaise, is rapidly growing and causing a constant increase in the production of salad oils.

It goes without saying that for many years to come cottonseed oil, on account of its abundance and good flavor, will be the chief source of supply. Corn oil, on account of its low cold test, is valuable to the mayonnaise maker in cold weather. Unfortunately it does not maintain its flavor as well as cottonseed oil, and seems to deteriorate quickly. Peanut oil is especially adapted to salad making, if properly winterized. To give the best results it should be deodorized. The same is true of sesame oil.

In selecting an oil for mayonnaise, it is very desirable to have one with the lowest possible free acid content. It has been found that free fatty acids act as a catalyser and start the formation of bodies which give the rancidity reaction with the Kreis test. Some years ago I investigated a complaint against some shortening which was exceptionally good. It was found that the flour used by the baker was old and of low grade. The wheat oil had all turned to fatty acid, which, when mixed with shortening, caused rancidity to start in. With careful handling and selection of materials oils can be turned out low in fatty acids, and such oils only should be used in the best products.

A few words about the Kreis test. For certain purposes this has proved very useful in experienced hands. There is still quite a little to be known about it and until it has been shown infallible its indications should be taken with care. Samples of oil are occasionally encountered that are very rancid and give no Kreis test; while, again, perfectly sweet flavored oils give heavy reaction. The quality of the reagents used also has a marked influence, and it has been found that with impure acid the test can be made valueless.

Perhaps it might not be out of place to say something about the food value of the different available salad oils. Experiments made by the Bureau of Home Economics in Washington have shown that they all are between 97 and 98 per cent digestible, and have a calorific value of 4,040 calories per pound. Herein lies the secret of the great food value of mayonnaise. Taking a standard product, containing 70 per cent oil and 8 per cent egg yolk, we have a fuel value of three thousand calories per pound, which shows that mayonnaise has a greater food value than many of our common articles of diet, as given in the following table:

One Pound	Calories
Eggs	765
Porterhouse steak	1110
Loin chops	1270
Cheese	1530
Bacon	2900
Mayonnaise	3000
Butter	3600

Available statistics showing the quantities of salad oils produced annually in this country are difficult to obtain. A fair estimate, it is believed, would place the figure in the neighborhood of three hundred thousand barrels of cottonseed oil alone. To this must be added fifty thousand barrels or so of corn and peanut oils.

Forthcoming Features in *Food Industries*

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By A. A. Schaal and Otto Johnson

"What Is Involved in Testing a Food for Vitamin D."
By E. J. Quinn

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By B. W. Dedrick

"Cold Packing of Small Fruits Looms Larger in the Industry."
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"Food Packing in Glass Follows New Paths."
By S. Henry Ayers

"Candy: A High Quality Food."
By H. D. Keiser

SCIENCE Raises the Standard of

BUTTER MAKING

By W. H. E. Reid
Professor of Dairy Manufactures, University of Missouri

CONSUMERS PAID APPROXIMATELY five and a half billion dollars for dairy products in the year 1925, and this is about one-fourth of their total expenditures for food. Even so, they made a splendid purchase, as they obtained from dairy products more than one-third of the energy value of all their food, and nearly one-fifth of its protein.

If to the value of dairy products there is added the value of dairy cows and bulls killed for beef, and the value of dairy calves for veal, the dairy cow would be credited with three billion dollars of the thirteen-billion-dollar farm production value in 1925. This was one-fourth of the farm value of all agricultural products.

Highly developed systems of collecting cream from producers are in general use, and technical cream grading is well-nigh universal

The total volume of butter manufactured in the United States in 1927 was 1,496,495,000 pounds. Per capita consumption of butter in the United States for 1920 was 14.70 pounds, and for the year 1925, only five years later, 17.04 pounds.

The art of butter making dates back to times immemorial. History treats butter as one of the oldest as well as one of the most universal articles of diet. It was used in some form two thousand years before the birth of Christ. References were made to butter in early Biblical and other ancient history. The word "butter" is mentioned in the Bible seven times. Scythians and Greeks used butter in 450 B.C. A little later on there is a record of the Persians' having made and used it.

In early centuries butter was employed in many ways. Hindoos offered it as a sacrifice in worship. Greek and Roman used it as a remedy for injuries to the skin. Romans used it as an ointment for skin and hair. Practice in Macedonia in cold regions was to use butter for the bath. In Spain, as late as the seventeenth century, it was found in medicine shops for external application. In Germany, unsalted fresh butter was employed as a cooling salve for burns.

In early times butter was not generally used as a food, except for the purpose of enriching other foods in cooking. It was stored in melted condition and was never eaten when fresh.

The churning of butter was brought about by agitation of whole milk, although there is a difference of opinion relative to the early methods practiced for creating agitation sufficient to gather butter. It has been said that some people placed milk in earthen vessels and heated the milk with their hands; others used wooden stirring sticks. The Arabs churned milk by placing milk in a leather bag and dragging it over the ground.

From these primitive practices the manufacture of butter has developed gradually by the use of the dash churn, the square box churn (used twenty years ago), and the table butter worker; until, today, we utilize the modern, up-to-date, combined churn and worker. The average capacity of the modern churn is 1,000 pounds of butter per churning, although in some countries churns having a capacity of 10,000 pounds are now used.

There are two great classes or groups of fats present in butter: the volatile and the non-volatile fats. The volatile fats are soluble and the non-volatile insoluble. The volatile fats include butyrin, caproin, caprylin, caprin, and laurin. Butyrin, present in largest proportion, is of most importance. It is the least stable of any of the butter fats. The non-volatile fats constitute about 92 per cent of the total fats in butter. Chemists agree that palmitin, stearin, olein, and myristin are the most important. Each fat largely causes the variation in the hardness and softness of butter and butter fat. Hardness of butter in fall and winter is due chiefly to the presence of slightly increased amounts of fats with high melting point.

The direct delivery of milk and cream is the oldest system practiced and marked the innovation of making butter in the factory rather than on the farm. Cream is transported by the producer direct to the creamery, having the advantage of permitting the creamery to make contact with the producer, at which time disputes are most satisfactorily settled. This system limits the cream supply territory to a narrow radius, the individual producer refusing to transport cream long distances.

The cream route system is made effective by the operation of trucks employed by the creamery for collecting the cream from the producer's door at regular intervals, usually three visits each week. Such a practice enlarges the gathering area, and brings the market close to the door of the patron. Its disadvantage lies in the inability of the creamery operator to maintain direct contact with the producer. As a result the quality of cream received from the route serves as a reliable index to the character and efficiency of the cream hauler. The introduction of the automobile truck has vastly increased the possibilities of the system.

In an endeavor to expand the milk and cream supply territory, creameries have established skimming sta-

tions, located at convenient hauling or shipping distances. The product delivered daily by the producer is immediately skimmed and tested, the cream being shipped to the central creamery. Cream only may be delivered to the station. This system in the central and far western section of this continent has been a tremendous factor in developing the dairy industry. The competition developed in the performance of this system is somewhat demoralizing, because of the reduction in the volume of milk and cream available for each station and the added expense of handling the butter fat received. These stations are located in places accessible to producers from various directions.

Until recent years the grading of cream for butter manufacture received little attention from the creameries. The same price was paid for good and indifferent cream, resulting in a general depreciation of the quality of the cream and the shipment to market of butter of unsatisfactory quality. Butter of inferior quality invited competition from foreign countries and the introduction of butter substitutes. The development of a reputation for American butter in foreign markets was slow and difficult.

During the last ten years a pure-food "wave" awakened the public to keener appreciation of the value of wholesome food products of good quality. Many of the creameries have, therefore, acknowledged the correctness of cream grading, and have undertaken the task of improving materially the quality of their raw product. The consuming public is making greater demands on the creameries for a butter that will score considerably higher in quality than butter made by the same creamery five years ago.

Progress in the development of a definite cream-grading program has been greatly retarded because of lack of confidence in the competitive creamery and possible loss of patrons, resulting in a decrease in the volume of butter fat received annually. Today, progressive creameries, large and small, are attempting to grade all cream received on a quality basis and make payments accordingly.

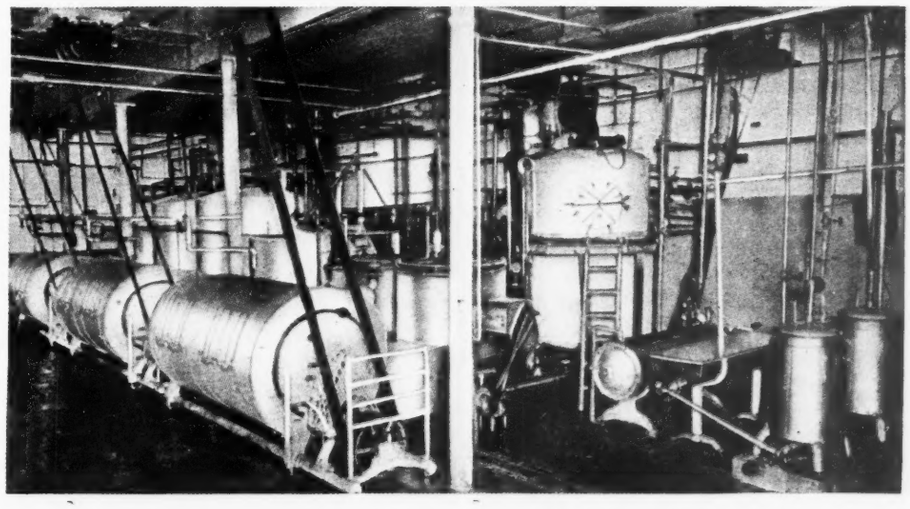
Although numerous methods have been given a trial, practically every attempt has failed. It seems that the "Four Day Plan" in some sections is proving successful. Regardless of success or failure to grade cream in the field, every creamery receiving a sufficient volume of raw product is applying rigid grading requirements of cream at the plant. This procedure is imperative.

The inauguration of a successful cream-grading program throughout this country would represent an annual saving of millions of dollars to the producer of cream and manufacturer of butter. The consuming public would then receive a larger volume of high-quality butter.

Cream for butter manufacture may be standardized for acid by the addition of an alkaline solution. This practice is commonly spoken of as cream neutralization. When cream is so standardized, the procedure minimizes the loss of fat that usually results from churning cream that is pasteurized while excessively high in acid; it aids in retarding the production of undesirable flavors in cream that are prone to result when cream that is high in acid is pasteurized at a high temperature; it decidedly improves the keeping quality of butter manufactured from high-acid cream.

The most commonly neutralized cream is not appreciably different from a product made of unstandardized cream, although the protein content is slightly reduced as a result of the practice. Standardization of cream for acid improves the flavor of the butter, adds the lime that is deficient in the average diet, and encourages pasteurization of all cream used in the manufacture of butter.

The pasteurization of cream for butter manufacture is accomplished by heating the cream to a temperature capable of destroying the great majority of bacteria and other ferments contained therein, and of cooling quickly to the ripening or churning temperature. Its objectives are: improvement of the flavor and keeping quality of butter; production of greater uniformity of quality; destruction of pathogenic types of organisms; an increase in the economic efficiency of the dairy industry.



A creamery adequately equipped with modern machinery

Various methods are practiced in the pasteurization of cream. In the performance of the flash, or continuous, process, the cream flows through the pasteurizer in a continuous stream, is heated to 176 to 185 deg. F., and immediately cooled to the ripening or churning temperature. The application of the vat, or holder, method is practiced by heating the cream in a vat equipped with an agitator to a temperature of about 145 deg. F., holding for thirty minutes and cooling to ripening or churning temperature. The combined flash and holding method permits the processing of large volumes of cream by causing the cream to flow through a continuous pasteurizer, during which time it is heated to a temperature of 150 to 170 deg. F. The cream is held in the vat at above or lower temperatures for ten to thirty minutes, and cooled.

The efficiency of cream pasteurization is evidenced by the number of bacteria destroyed when cream is heated to 145 deg. F. and held at that temperature for thirty minutes. Of the total bacteria present, 99.99 per cent are destroyed. The per cent decrease of various types of bacteria can be said to be: acidifiers, 99.999; liquifiers, 99.98; yeasts and molds, 99.94. The heating of cream to 176 deg. F. or higher is destructive of the activity of enzymes naturally present, although at 145 deg. F. enzyme action is not destroyed. The presence of

enzymes in butter may render possible splitting the butter fat and attacking the milk proteins, especially butter from cream of inferior quality that is contaminated with diverse species of bacteria. Experimental data demonstrate that butter from cream of both good and poor quality is greatly improved, and keeps better when made from properly pasteurized cream than does butter made from raw cream.

The aeration of cream improves its quality decidedly and results in the manufacture of butter of a higher quality. The purpose of this process is to facilitate the escape from cream of objectionable volatile substances and gases that harbor undesirable odors and flavors. The results desired may be accomplished by exposing the cream in a thin layer to the atmospheric conditions, by blowing air through the cream, and by drawing air and gases out of the cream by suction.

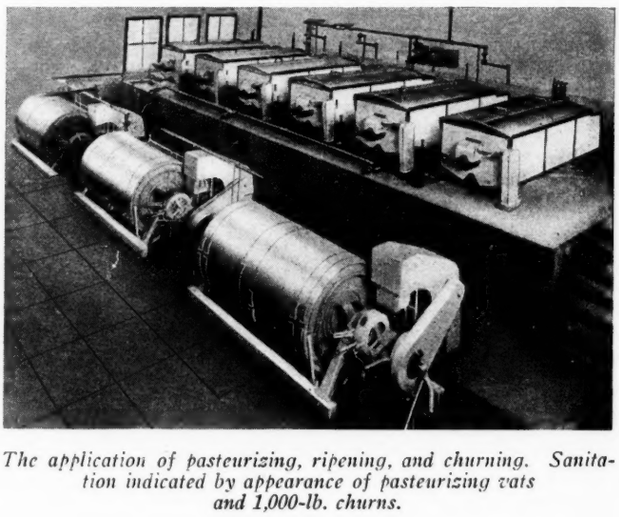
The first method consists in running hot cream from the pasteurizer over a surface coil cooler. The effect of the second method is not only to bring the cream in contact with the maximum amount of air, but to cause this air to blow through the cream and thereby mechanically force the gases out of the cream.

Any procedure of aeration that causes air to mix with the cream is positively objectionable, because the atmosphere is an active oxidizing agent and hastens deterioration of the finished product. The greater the volume of air present, the more rapid and more intense is the destructive action. This destructive action is further intensified by the application of heat to the cream and by the exposure of the cream to the copper parts of the aerator, the explanation being that the heat and acid of the cream act on the copper as active oxidizers and catalyzers.

A starter is a culture of active lactic acid bacteria growing in milk and used primarily to control the fermentation in butter manufacture. It is known that certain bacteria are responsible for the fermentation process and the development of desirable flavors. The general forms of media are powdered and liquid and are mixed cultures, the common lactic acid organism (*Streptococcus Lacticus*) associated with types developing volatile flavor- and aroma-producing acids. The lactic acid, which is non-volatile, produces an acid flavor, but very little of the flavor and aroma so characteristic of a good, well-ripened cream and butter come from it. Organisms found most suitable as associate organisms of the lactic acid organism (*Streptococcus lacticus*) are *Streptococcus paracitrovorous* and *Streptococcus citrovorus.* The last named acts upon the citric acid of milk and cream and to a certain extent upon its lactic acid, converting them into volatile, flavor- and aroma-producing acids. *Streptococcus paracitrovorous,* having the same function, also develops and uses another product.

A desirable starter is one that will develop a fair proportion of volatile flavor- and aroma-producing acids without developing an excess of acidity. The great problem is maintenance of a proper balance between the lactic acid organism and the associate organism or organisms, which develop the volatile flavor- and aroma-producing acids. One large factor is a proper ripening temperature in both starter and cream ripening. The desirable temperature is a range of 70 to 72 deg. F. A setting temperature that is too low will produce a starter that is slow in coagulating, has a soft curd, often slimy and ropy, the flavor being flat, insipid, sweet, or bitter. Should the setting temperature be too high, coagulation is premature and causes production of whey, gas, a lumpy or watery body, with a flavor described as flat, insipid, vinegar, or foul.

When present in the starter, these defects are transmitted to the cream to be ripened and may appear in the finished butter. A starter showing evidence of not being perfect should be discarded and a new culture obtained. Financial losses can be incurred by the use of an inferior starter. Skim milk powder is used in the preparation of the starter when fluid skim milk is not available. The product furnishes a very satisfactory media and is less perishable than the fluid skim milk. It can be kept in stock indefinitely and is always fresh. Starters are very



The application of pasteurizing, ripening, and churning. Sanitation indicated by appearance of pasteurizing vats and 1,000-lb. churns.

important in butter manufacture because of their relation to the flavor and aroma of the butter.

Ripening of cream prior to actual manufacture of the butter is the treatment the cream receives from the time it is put into the ripening vat until it is put into the churn, including the chemical, biological, and physical changes it undergoes during that time. Cream is ripened in order to produce a desired aroma and flavor in the butter, and, in addition, to shorten the time required to churn and to decrease the fat content of the buttermilk.

The chemical changes that result in the development of an aroma and flavor are not well understood. It is thought that the palate flavor is derived from the volatile fatty acid and the aroma resulting from the fermentation of the milk sugar. Authorities are agreed that the flavoring substances developed are decomposition products of bacterial growth, the types producing lactic acid being the most desired.

The ripening temperature of cream usually ranges between 60 and 75 deg. F. Lactic acid organisms and those associated with them in a desirable starter have the greatest relative growth at 70 deg. F. A temperature range of 65 to 70 deg. F. is most satisfactory for summer, and 70 to 74 deg. F. during the winter.

The amount of starter added to the cream for ripening purposes is dependent on the ripening temperature, length of ripening period, richness of cream, to some extent the cost of the milk or skim milk used, market demand as to fullness of flavor in the butter, length of time the butter is likely to be held prior to sale, and whether the cream is sweet or sour and has been neutralized.

When properly performed this process gives very satisfactory results. Cream if not sufficiently ripened lacks flavor and aroma, and is difficult to churn, the buttermilk containing excessive butter fat. Cream overripened

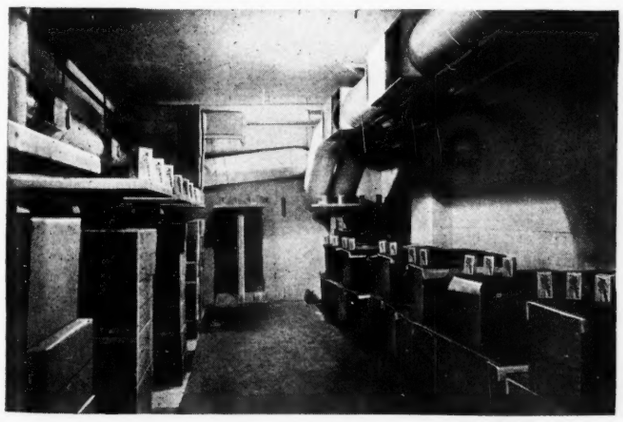
may possess flavors of different kinds, such as metallic or fishy, and has poor keeping qualities. The practice of using a temperature that is too high or too low usually gives the butter a flat or bitter flavor. When insufficient starter is added to the cream, bacteria that may have survived the pasteurization temperature grow and produce an undesirable aroma and flavor in the cream and resultant butter.

The philosophy of churning cream is the formation of butter granules brought about by crystallization or solidification of fat in the fat globules and by coalescence of wholly or partly solidified fat globules into butter granules. The purpose of churning is to separate the butter fat from the caseous and serous parts of milk and cream—in other words, to make butter.

The question constantly arises as to what causes fat globules to remain apart and what prevents their running together like oil. Fat globules remain individual primarily because of the law of surface tension. They also retain their individuality because of the assistance given by the law of adsorption and the viscosity of the milk. The permanent emulsion of fat globules is enhanced by the natural viscosity of skim milk, caused by the presence of colloids (albumen, casein) and of milk sugar.

The cream thickens in the churn as the operation progresses, due in part to the increased size of the microscopic, or semi-microscopic, butter granules. Up to a certain point the larger these microscopic granules become, the thicker and more rigid the cream. Thickening of the cream in the early part of the process is due to profuse incorporation of air in viscous, cold cream. The presence of air in butter represents an active agent of butter deterioration.

The butter suddenly "breaks" because the surface butter granules become so small in proportion to the cubic contents that fat-in-skim milk emulsion can no longer be sustained and the emulsion is broken. The "breaking" of butter emulsion changes from a fat-in-skim milk



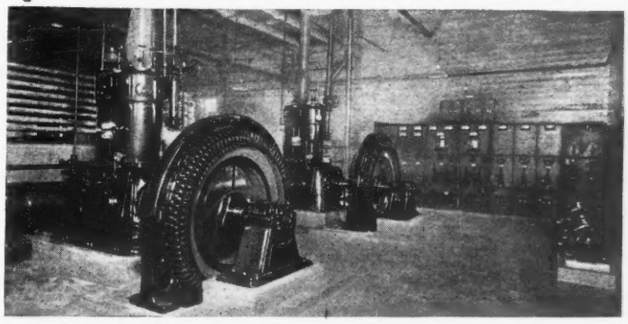
Sanitary storage rooms of low temperature preserve the food qualities of butter indefinitely

emulsion, as represented by cream, to a buttermilk-in-fat emulsion, as represented by butter. The final solidification of the fat globules is caused by the low temperature and concussion.

Coalescence, as applied in butter manufacture, means the uniting and adhering of fat globules and butter granules, determined by extent of solidification and amount of concussion. Coalescence is affected by the size of the fat globules, adsorption, and the viscosity of the cream.

Conditions that affect the churnability of cream and the mechanical firmness of the resultant butter are: size of the fat globules, chemical properties of the butter fat, viscosity of the cream, churning temperature, length of time cream is held at churning temperature, richness and acidity of the cream, nature and amount of agitation, speed of churn, and amount of cream in churn.

Color, which is added immediately before commencing the operation of the churn, gives uniformity to the butter.



Electrically driven refrigerant compressors maintain low temperatures in cold storage rooms

The amount added is dependent upon the season of the year and market demand. When the butter granules are the proper size, the buttermilk is removed from the churn and tested for butter fat to determine the efficiency of the processes involved.

The butter granules are thoroughly washed to free the butter from any remaining buttermilk that may adhere to them, to harden the butter in case the butter shows a weak body, and to remove undesirable flavors in case the original cream may have been of somewhat inferior quality. The wash water is carefully tempered, as it reflects directly on the physical and chemical properties of the butter. A high temperature of wash water tends toward a slight increase in moisture content of the butter, softens the butter, and may modify the effect of subsequent working.

The addition of salt to butter will lend flavor desired by the consumer. Salt added in proper increments has no material effect on the keeping quality of the butter. The amount added depends primarily on the market for which the butter is intended. Butter fat is not a solvent of salt, and moisture must be present to cause the salt to become a brine solution. The more moisture the butter contains, the more salt it is capable of holding in solution.

A butter salt should have a high degree of purity, both bacteriologically and chemically, and should be of the proper physical consistency. Best salts contain from 98 to 99 per cent pure sodium chloride. In addition to sodium chloride, salt as offered for sale contains varying amounts of gypsum, calcium chloride, and magnesium chloride. Gypsum reduces the solubility of salt. Magnesium chloride gives butter a distinctly bitter flavor.

The chemical purity of salt is determined by the purity of the mother brine and the process of manufacture used for the elimination of the natural impurities contained in the brine. It is of the utmost importance that salt be present in the form of crystals of the proper form and size. This factor controls readiness to dissolve and ease of being retained in the butter. Crystals must be of medium coarseness.

When salt crystals are too fine, salt is prone to be pasty, which renders its uniform distribution difficult. Excessively small crystals hinder the expulsion of butter-

milk. Drops of buttermilk, which each crystal is capable of taking up, are so small that their complete and ready expulsion is hampered. Salt has the power of inhibiting bacteriological growth. This is especially true of the growth of water bacteria. Some authorities are of the opinion that the molds are affected by salt in butter more than bacteria and yeast.

When butter is worked by the use of the modern churn, and the operation performed effectively, the salt is completely dissolved, uniformly distributed, and properly evaporated. In addition, a complete fusion between the brine and water in the butter has been accomplished; the butter granules have been brought together into a compact mass for convenience in handling and packing; a part of the remaining buttermilk has been expelled, and control of the moisture content of the butter materially assisted. Butter that has been properly worked has a tough, waxy body, is free from leakiness, greasiness, and tallowiness, and has a bright, uniform color.

Today the manufacturer of butter finds it necessary frequently to tour the country for the purpose of acquainting himself with the consumers' demands as to the types of packages in which butter may be dispensed. Commonly butter is packaged for the retail trade in pound, half-pound, quarter-pound, and eighth-pound prints. Each additional cut of the original print increases the cost to the consumer; however, it seems that the buying public is willing to pay the increased price to secure a package which meets its approval.

The marked development that has occurred in every branch of the creamery industry, including butter manufacture, has resulted from scientific investigation. Chemical, bacteriological, and physical studies of problems pertinent to each respective phase of butter manufacture have made it possible to manufacture a product that is satisfying the public demand.

The personnel of many of the larger creameries is comprised primarily of scientific, thinking executives. These men are charged with the responsibility of solving the problems that present themselves from the time of the production of the milk until the finished product, butter, has been consumed. Scientific findings of experts in nutrition have proved invaluable in causing the consuming public to acquire a better understanding of the relation of butter to the daily diet.

Many problems in the manufacture of butter remain unsolved. Science, in time, will enlighten us regarding the unknown.

Canners Would Brand Sub-Standard Foods

IN ORDER to amend the Food and Drugs Act of 1906 with the view of requiring canned foods below a specified standard of quality to carry an identifying statement to this effect a bill was introduced in Congress on Dec. 10, 1928. In the Senate it is S.4800, sponsored by Senator McNary, of Oregon, the corresponding House bill being H.R.15218, introduced by Representative Maples of Michigan. The bill was drafted by the committee on special legislation of the National Canners Association upon the recommendation of their committee on general advertising.

The text of the proposed amendment follows:

A BILL

To amend Section 8 of the Act entitled "An Act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," approved June 30, 1906, as amended.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled that Section 8 of the Act of June 30, 1906, entitled "An act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes," as amended, is amended by adding at the end thereof the following:

Fifth—If it be canned food and falls below the standard of quality, condition, and/or fill of container, promulgated by the Secretary of Agriculture for such canned food, and its package or label does not bear a plain and conspicuous statement prescribed by the Secretary of Agriculture indicating that such canned food falls below such standard. For the purposes of this paragraph, the words "canned food" mean all food which is in hermetically sealed containers and is sterilized by heat, except meat and meat food products which are subject to the provisions of the Meat Inspection Act of March 4, 1907 (34 Stat. 1260), as amended, and except canned milk. The word "class" means and is limited to a generic product for which a standard is to be established and does not mean a grade, variety, or species of a generic product. The Secretary of Agriculture is authorized to determine, establish, and promulgate, from time to time, a reasonable standard of quality, condition, and/or fill of container for each class of canned food as will, in his judgment, promote honesty and fair dealing in the interest of the consumer; and he is authorized to alter or modify such standard from time to time as, in his judgment, honesty and fair dealing in the interest of the consumer may require. The Secretary of Agriculture is further authorized to prescribe and promulgate from time to time the form of statement which must appear in a plain and conspicuous manner on each package or label of canned food which falls below the standard promulgated by him, and which will indicate that such canned food falls below such standard; and he is authorized to alter or modify such form of statement, from time to time, as in his judgment may be necessary. In promulgating such standards and forms of statements, and any alteration or modification thereof, the Secretary of Agriculture shall specify the date or dates when such standards shall become effective, or after which such statements shall be used, and shall give public notice not less than ninety days in advance of the date or dates on which such standards shall become effective or such statements shall be used. Nothing in this paragraph shall be construed to authorize the manufacture, sale, shipment, or transportation, of adulterated or misbranded foods.

In connection with this measure, it should be borne in mind that the standards of quality thus established are not to be confused with present commercial gradings, or with standards and grades formulated by the Joint Committee on Definitions and Standards of the U. S. Department of Agriculture for the guidance of food law officials, or with those adopted by the federal officials in charge of enforcing the Warehouse Act.

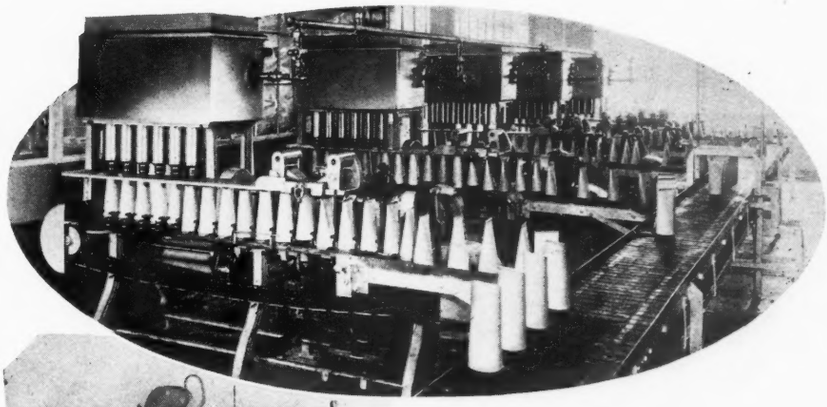
In addition to the endorsement of the National Canners Association the bill has also received the approval of the Association of New York State Canners on December 14. Also the Maryland State Food and Drug Commissioner, Dr. A. L. Sullivan, is quoted in *The Canning Trade*, Jan. 14, 1929, as saying ". . . that such an amendment providing for the plain labelling of sub-standard canned foods is a step in the right direction."

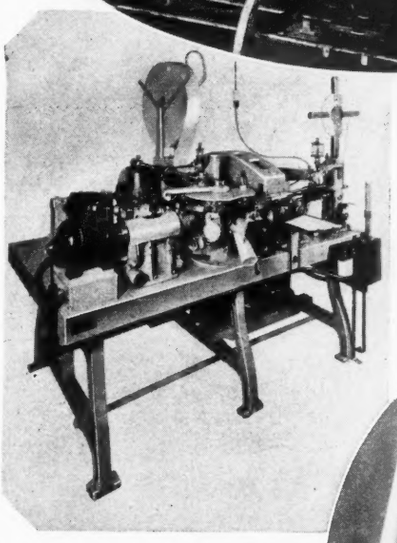
Milk Distributors Experiment With Improved Paper Container

THE supremacy of the familiar glass milk bottle is challenged by a new paper container, offered by the Sealed Container Corporation, New York.

The Sheffield Farms Company is using the new container experimentally for its store trade in northern New York City. Obviously, if experimentation demonstrates suitability for milk, it will be entitled to serious consideration for use with many other foods of liquid or plastic nature that are now packed in glass, tin, or less sturdy forms of paper.

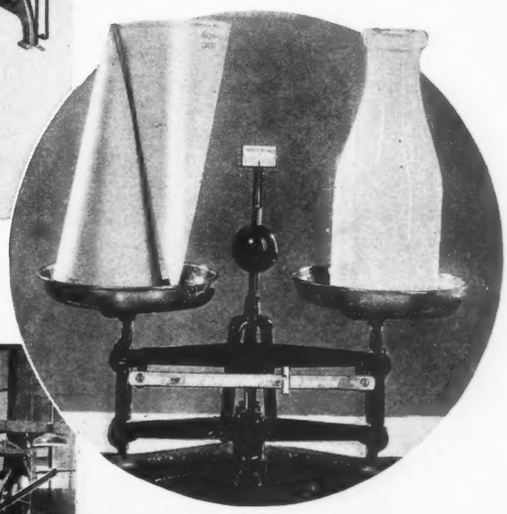
The new container, known as the Sealcone, is said to be the result of nearly fifteen years of experimentation, its adoption having been advocated by R. R. Reilly, whose father, Dr. Frank W. Reilly, was Assistant Health Commissioner in Chicago when glass bottles were introduced there. It is light in weight and yet sturdy enough to withstand handling; sufficiently translucent to show the cream line; impervious to liquid and air; and when made on the premises *(as it should be)* is sterile, thereby keeping milk sweet for a relatively long time. The material used is a poor conductor of heat, of a thermal conductivity about one-third that of ordinary glass. By means of a metal strip (dated), the content is positively sealed against possible tampering, and it is non-refillable.



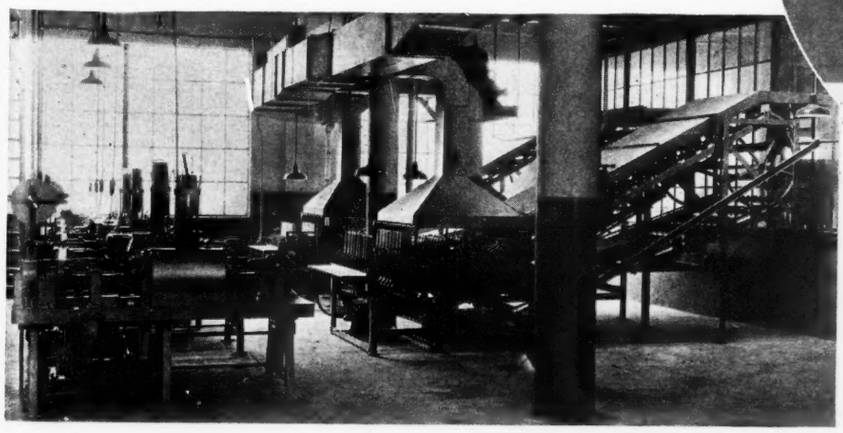


A close-up of the container-making machine included in the view shown below

Pasteurized milk at 33 to 35 deg. F. is run, without foaming, into sterile Sealcones. The container weighs only 2 oz., so the resultant temperature of the filled package (weight 34 oz.) is not materially raised, thereby permitting local delivery without icing.



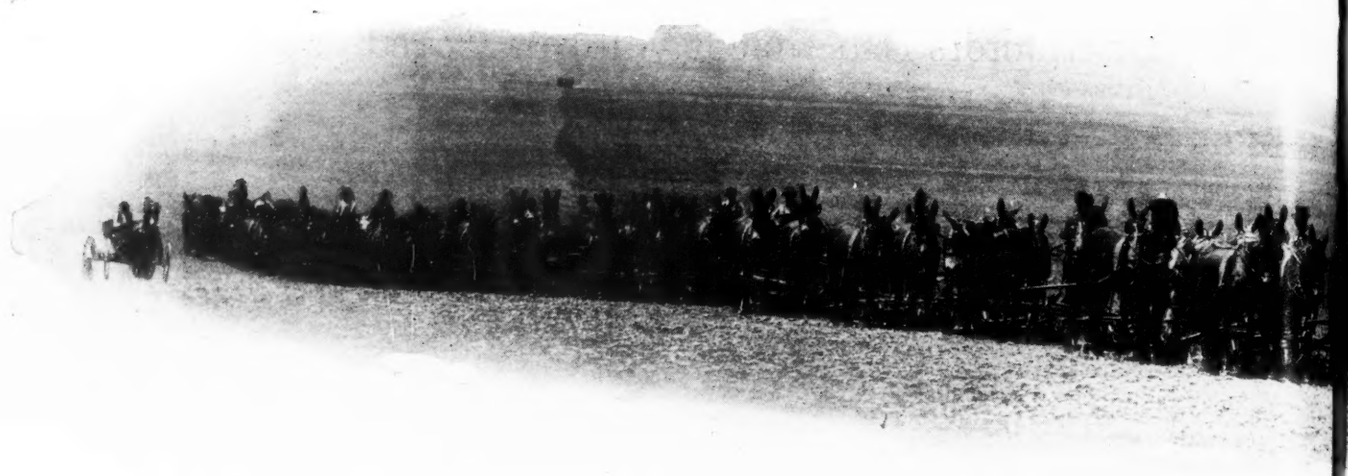
Two quarts of milk in paper weigh but 7 oz. more than one quart in glass: 68 oz. compared with 60.4 oz.



The accompanying views are of the experimental installation. The container-making, waxing, and drying units are shown immediately above, and the filling and sealing machines at the top of the page. Both equipment and paper stock are patented, the machines being leased. Supplies may be purchased either from the licensor or in the open market.

Where the new container is made, then bathed in fluid paraffin wax, and immediately dried to insure sterility

The milk is made ready for use by cutting off the top, slitting the wall of the container or nicking the edge with a small V.



CO-OPERATIVE RESEARCH

Solves Important P

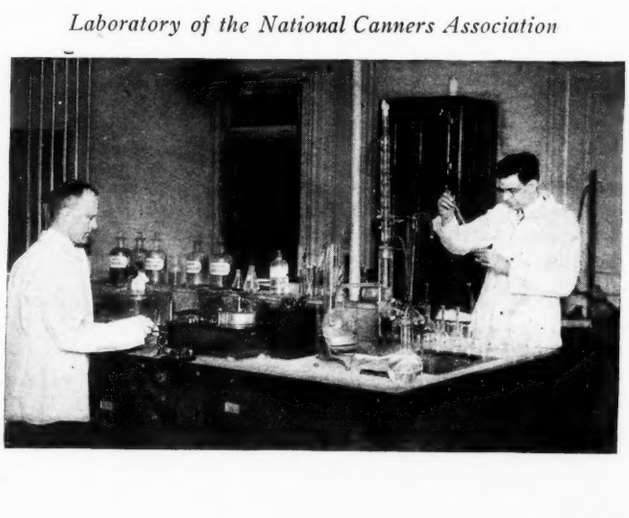
CANNING I

MECHANICAL DEVELOPMENTS which have made the canning industry a commercial possibility, and the more fundamental scientific researches which established its technological success, have been described in the preceding installment.* The laws governing the rate of heat penetration are now understood; further, we are now in possession of a fairly complete knowledge of the rate of death of bacteria at elevated temperatures.

Science has furnished the yardstick by which can be measured the effect of heating the contents of a hermetically sealed can, but in occasional instances there have been abnormalities. Many bacteria that should have died during the process were still alive and caused spoilage if cans were not properly cooled. These exceptional bacteria were isolated, studied, and found to be organisms possessing spores exhibiting extreme resistance to heat as well as ability to grow at temperatures too high for any other known forms of life. Previously suspected of existing, it was only now that their real characteristics could be understood; but the problem was only half solved, for no one knew where they came from. Various theories, advanced a few years ago, to account for their entrance into the most carefully operated and most sanitary canning factories, are less intriguing since Dr. E. J. Cameron, a more recent addition to the research staff of the association, found that sugar was a source of an occasional infection by this troublesome form of life. Others, such as Dr. L. J. James, of the Bureau of Chemistry and Soils, have confirmed this finding, and here the matter is at present.

So far attention has been paid only to the pure theory of canning, and it is now time to turn back to early days to trace the developments of another phase of the industry pertaining to the canned product itself. Though it may appear arbitrary to separate bacteriological changes in the product from all other changes, there is a certain degree of justification, because it is extremely difficult, for this writer, at least, to dissociate absence of bacteriological spoilage from the very science of canning. If it were possible to contemplate commercial canned foods—as an abstraction—that were neither sterile nor antiseptic through high acidity or high sugar concentration, then these would be no logical basis whatever for discussing changes or spoilage separately from the theory and fundamental science of canning. Strange and perplexing things sometimes happen to canned foods, as nearly any canner knows all too well. And it has not been always possible to find out why they have occurred. Research has discovered enough about them to divide them into two general types of problems: those that are caused by changes occurring before canning, and those that occur after canning.

Laboratory of the National Canners Association



*The opening portion of this article was published in the January issue. This is the conclusion.

Huge tracts are farmed to control quality. A unit of the Hoopeston (Ill.) Canning Company.

Problems of the INDUSTRY

By LAURENCE V. BURTON
Assistant Editor

Offices and research laboratories of National Canners Association, Washington, D. C.

Bacteriological and chemical investigations by Clark, Clough, Fellers, and Hunter have shown the way to better handling of salmon before canning and have done much to eliminate the promiscuous pughing of fish with the one-tined fork, a method of handling which introduces bacteria into the deeper tissues of the flesh, and which, in the past, has resulted in a loss of quality.

Similar studies have been carried out by government as well as association scientists on the sardine industry in Maine and have gone a long way in improving the quality of the fresh herring received by the canning factory.

Gowen has published a paper on the effect of holding shelled peas too long before canning and has given quantitative data on the deleterious effect of this practice. Chemists at several of the agricultural experiment stations have measured the rapid disappearance of sugar from the kernels of corn after the ear has been picked. Both of these studies have indicated the prime importance of canning a product within the shortest possible time after harvesting. The slogan of the pea canner—an hour from field to can—has a real basis, and quality can be maintained only by observance of the rule.

Among the studies of changes occurring in canned products after canning are some which have required years of study and enormous expense, in which canned corn has had more attention than any other product. One type of discoloration is occasionally present in canned corn that is characterized by a graying of the product. In one of the earliest bulletins of the National Canners Association, Bigelow, in 1915, reported that the trouble was due to infinitesimal amounts of copper that the corn had absorbed from brass parts of the mixing and filling machinery. Remedies were pointed out, and though the same form of trouble occasionally occurs today the well-informed plant operator realizes that it has been due to a human failure and not to unknown causes.

The other and more important form of discoloration of canned corn that has caused far more trouble is called "corn black," and, as its name implies, was an actual blackening of a portion of the corn. In extreme cases the area of black was as large as the top of the can and occurred at the upper surface of the product after it had stood in one position for several months. More frequently, however, the black appeared as irregular streaks and spots resembling dirt, on the inside of the

E. D. Clark

W. D. Bigelow

J. Russell Esty

can. Probably no problem of the entire canning industry has caused more trouble or involved more extensive researches than "corn black," for its cause was not one that could be explained to the lay consumer. Nothing could be gained by informing an irate purchaser that the black was only iron sulphide, and that the sulphur, that combined with iron from the can to form the intensely black iron sulphide, came from the corn itself. Chemists knew perfectly well what the trouble was, but for many years they were powerless to prevent it.

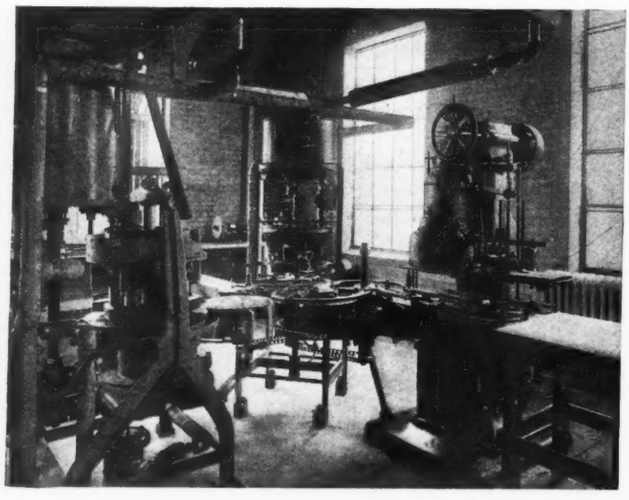
Where tin is soldered, a zinc chloride flux is the commonest flux to use. In the "hole-and-cap" can a very trifling amount of this flux was present at every soldered joint, whereas in the "sanitary" can only one joint on the side of the can was soldered and it was usually done with a flux containing no zinc. The heating of any protein material to the temperatures used in sterilizing corn will always bring about a partial decomposition accompanied by liberation of a small amount of hydrogen sulphide. If any iron is present in solution, black iron sulphide will be formed. But if the tiniest trace of zinc is present the sulphur combines with the zinc to form zinc sulphide, which is a compound that happens to be white instead of black, and, hence, is unnoticed. The black did not appear regularly, nor under any definite set of conditions. Corn was packed in special plain steel cans entirely devoid of tin to determine if exposed iron was at fault, and to the great surprise of everyone the corn in this experiment showed no more black than corn packed in tin-coated containers. The final solution of the problem has been by the use of what is called "C-enameled" cans. Tin plate is coated with an insoluble enamel that contains insoluble zinc oxide and is made into cans with the enamel side on the interior. Any hydrogen sulphide liberated by the cooking of the corn is captured by the zinc and is thus removed from the scene of possible activity.

The names of those who have contributed to the solution of the "corn black" problem are many. The name of Dr. G. S. Bohart appears on the patent granted on the "C-enamel," and to him is due the credit for the final step in the solution; but the names of Fitzgerald, Kohman, Bigelow, Stevenson, Morgan, Harrison, Huelson, Hofer, B. S. Clark, and others should be remembered in the search for the remedy for "corn black" that lasted fully twelve years.

Canned peas in plain tin cans frequently cause the development of discolored spots on the can, which, although not objectionable, and despite the fact that they are absolutely harmless, are undesirable from the standpoint of good appearance. Like the black of canned corn they are caused by sulphides. As soon as the "C-enamel" was developed for corn it was also tried for peas and found to be entirely successful.

Similar black iron sulphide discoloration has been the cause of much trouble among packers of shrimp, lobsters, and clams, but "C-enamel" has apparently solved all these problems and is being introduced in these lines of canning as rapidly as possible.

Blackening has also been found to occur in some of the western fruits—an unlooked-for occurrence that caused much perplexity, because fruits have too small



Experimental canning factory, University of Illinois. Filler and closing machine.

an amount of protein matter to give the necessary amounts of hydrogen sulphide when heated to account for the amount of iron sulphide found. Miller and Bigelow discovered two new sources of sulphur, one being the sulphur dioxide in the sugar used in the sirups, the other being in the rubber in newly installed inspection belts.

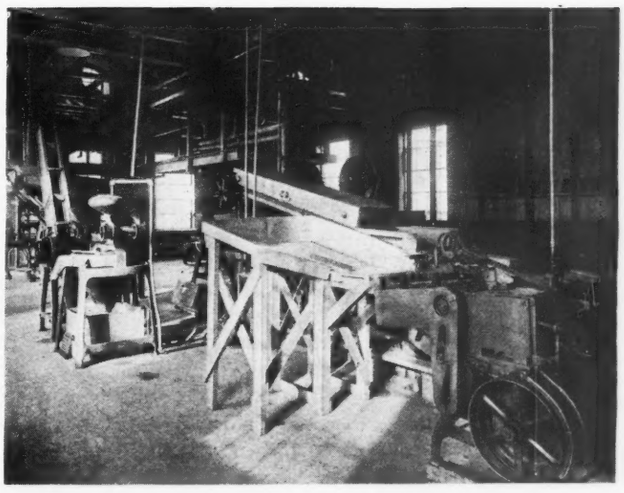
To Henry L. Huenink is due the first observation that hard water plays an important rôle in the canning of vegetables. Working as a chemist in the Illinois State Survey in 1911, he showed the toughening effect of hardness in water on beans and asparagus. Bigelow and Stevenson have since published their conclusions on the subject, and many canners now employ water softeners in their factories to preserve the original tenderness of vegetables.

A pungent bitter taste in peas canned in a Michigan factory led Kohman to discover an odd fact. River water was filtered and chlorinated for the municipal water supply that was used for making the brine for the peas. He discovered that a gas house a short distance up stream was discharging waste water into the river that carried phenol (carbolic acid) in small amounts, but the quantities were sufficient to react with chlorine under the heat of sterilization to produce an aromatic product that ruined the peas.

Canned sweet potatoes frequently turned black and caused much consternation. It was found that the trouble could be avoided by excluding all oxygen from the can, through tight stuffing, thorough exhaust, and tight seams.

The perforations of canned apples or cider, a few years ago, rendered almost every pack unmerchantable within a short time after canning. It is probable that the first idea as to the method of combating the evil came from Mikesell, of Traverse City, Mich. The "hunch" was developed by W. S. Sellars, and to him is due credit for working out the method of oxygen removal from apples as a means of preventing perforations. Kohman has added to a more complete understanding of the problem.

Another important form of research is the careful study being made of all cases of food poisoning alleged to be due to eating canned foods. The accumulation of data now affords a formidable mass of evidence. Snap diagnosis and careless statements ascribing the cause of human ills to canned foods are no longer the successful basis of damage suits.

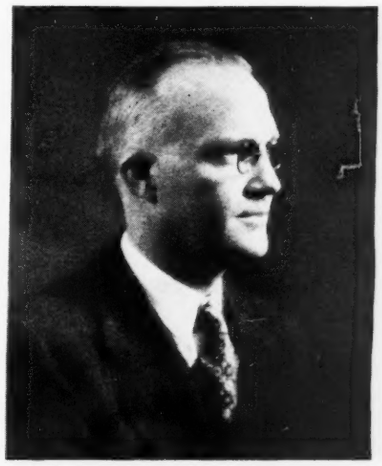


Experimental canning factory, University of Illinois. Corn huskers.

The investigations have also the important effect of selling the canner the idea that his goods deserve defending. It is not so very many years ago—less than ten—that a large manufacturer settled a suit for losses out of court rather than fight an obvious fraud and undergo the unpleasant—though temporary—notoriety, even though this writer had personally investigated the case and found that the death was due to a physician's error of diagnosis of an internal disorder. With increasing experience the industry is now beginning to hit back at its fa'se accusers. The ambulance chaser must be taught that hope of successful damage suits against canners is very remote, for truth is largely on the side of the canner. The National Canners Association undertakes the defense of its members, and institutes most careful epidemiological investigations of all cases of alleged food poisoning through the aid of some impartial research organization properly qualified to do this sort of work.

The whole subject of food poisoning is one which is still in the developmental stage, and its history is yet in the making. The canning industry through its national association has contributed greatly to these studies by large grants of money to Rosenau at Harvard, to Jordan at Chicago, and Meyer at Stanford, for bacteriological, etiological, and toxicological investigation of outbreaks

E. J. Cameron



G. S. Bohart

E. F. Kohman

of food poisoning. No strings have been attached to their grants of money. Their sole purpose is to get the facts and publish them.

Many of the most successful canning companies in the United States are not only preservers, but also creators of their raw materials. It so happens that nearly all canning crops pass through a period of maturity when their quality is at its best and deteriorate rapidly if the time of harvest is deferred beyond the fleeting hours of perfection. Dependence upon the average farmer to exercise correct judgment as to the proper time to harvest a crop is as unwarranted a display of faith in human nature as asking an obliging stranger to hold one's pocket book, and, unless there is some method of compelling the grower to harvest at the proper period of maturity, the quality of raw materials received at the canning factory will be governed largely by the convenience of the several growers.

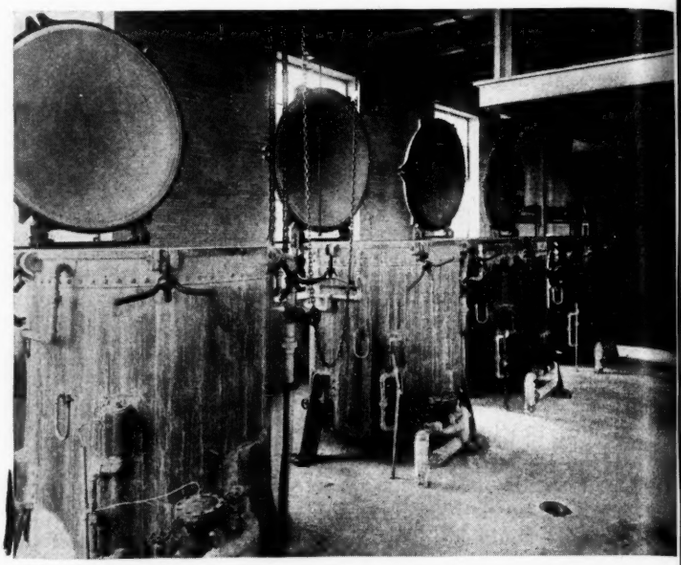
Recognition of this fact has developed several systems which attempt to cope with the problem of quality control. One method is that of employing a field man who, theoretically, is a supersalesman combining character, force, wit, integrity, personality, pugnacity, evasiveness, cajolery, and all other human virtues in judicious proportions. He should be a man of standing in the community, his word must be as good as his bond, he must have led a blameless life and have no past record of dishonesty or sharp dealing that may be resurrected to torment him or force him to make decisions prejudicial to his employer's interest. He should be a man old enough to know all growers by their first names, and should know how to raise the crop in question to perfection and in abundance and thus be enabled to inform others how to make lots of money, and yet, himself, be willing to work for $35 per week.

W. H. Harrison

Such a paragon of virtues can deal with a hundred or more growers to the end that the crop is harvested at the right time, but he is a rare individual, and if a canning corporation can count him among its personnel it is indeed fortunate.

Another system of insuring proper harvest and delivery of canning crops is the quality-bonus system—a plan that has been fostered by the U. S. Department of Agriculture for the purchase of tomatoes and is now being tried out in a number of states. According to reports from several sources it is very helpful when adapted to meet local conditions, but its present status is one most easily described as the period of selling the idea. Much hard work is still ahead of the tomato packer. Successful bonus schemes for quality improvement have yet to be developed in the other lines.

A third system of obtaining proper quality of raw material is that of producing the crops themselves under conditions where all deliveries are definitely under the control of the packer. In return for controlled quality the packer must assume the crop hazard, and, though the latter is at times a severe penalty, the benefits are more often on the right side of the ledger. It is a practice carried out on an enormous scale in the Hawaiian Islands and to a lesser extent in continental United States in many lines such as asparagus in California and Illinois, peas in Illinois and Wisconsin, cranberries in Massachusetts, corn in Illinois, and cherries in Wisconsin.



Retorts in the experimental canning factory at the University of Illinois

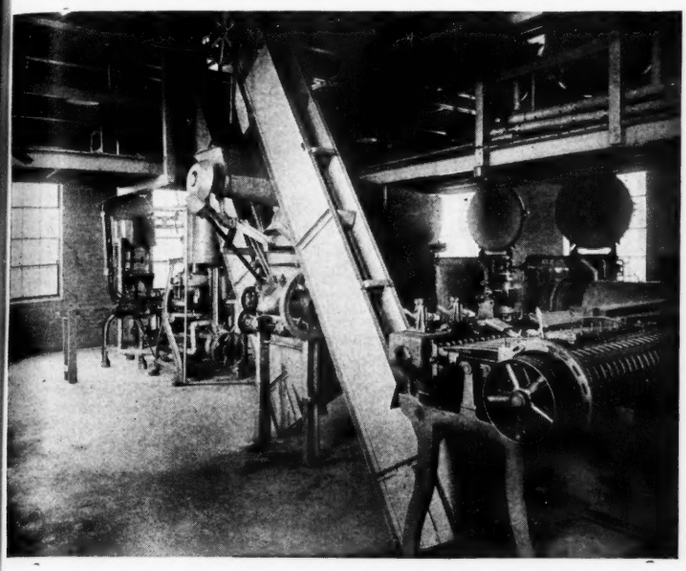
The problem of quality control does not end here, however, for many things are still to be desired. More uniformly developing and maturing peas have been produced, but the ideal has not been attained. Progress, however, has gone far enough to permit machine harvesting of peas without the inclusion of too great extremes of maturity, but in the production of string beans the development of the suitable type plant is still far in the future. A bean is needed that will mature many pods simultaneously instead of with the usual succession of maturities, ranging from hard beans at the bottom of the plant to blossoms at the tip, that require hand picking in order to secure proper maturity as well as a satisfactory yield.

Corn, although a highly developed plant, is capable of further improvement both as to yield and quality. A tremendous hazard faces the corn-canning industry in the near future in the steady advance of the European corn borer toward the sweet corn producing states of the Mississippi valley. It is to be hoped that science will find a means of effective control of the pest in the next few years before its spread becomes general. The federal government, recognizing the grave menace of the corn borer, has appropriated as much as $10,000,000 for use in its control, but has been stopped in its work by court injunctions. From the behavior of certain agricultural groups one could almost be led into believing that they actually welcome the advent of the European corn borer. Their efforts to stop the federal attempts to control the pest may, of course, be based on an unvoiced conviction that it is a heaven-sent cure of the farm surplus problem.

Disease-resistant varieties of all sorts of fruits and vegetables are needed, where cheap and easily applied remedies are not available. Chlorosis, a physiological deficiency of iron in pineapples, was found by Westgate

and others to be easily cured by spraying the plants with iron sulphate, but simple remedies like this are rare. Parasitic diseases which do not respond to treatment are frequently solved by development of new types of plants that are resistant to infection.

Researches on the agricultural problems of the canning industry are carried out at many places. Many of the larger factors in the industry retain agricultural experts



Experimental canning factory, University of Illinois. Corn cutters below; tomato pulp kettles overhead.

who are studying their local problems. Federal and state agricultural experiment stations in states where canning is commercially important have canning crop specialists who are constantly at work. A few states have canning experiment stations, such as the factory at the University of Illinois or the fruit products laboratories at the University of California.

Recognizing the need for co-ordinated research on the agricultural side of canning, the National Canners Association maintains a bureau of raw-products research headed by Prof. Charles G. Woodbury, former director of the Purdue Agricultural Experiment Station, which maintains efficient liaison between the industry and the various research groups and keeps each well informed of the needs and progress of the other. New knowledge available anywhere in the world is quickly brought to the attention of the canning industry.

One of the most recent developments is the installation of an agricultural adviser in the organization of one of the large can companies. It is interesting to note that one of the largest canning companies never buys or builds a new factory without the full approval of an outside consulting agronomist as well as its own agricultural staff.

The Indiana Canners Association, together with Purdue Agricultural Experiment Station, have been carrying on a very important development of an improved strain of tomatoes which has resulted in the Indiana Baltimore. MacGillivray at Purdue is measuring the quality of the tomato, a step which is fundamental to further seed improvement.

It should also be pointed out that the seedsman is an important factor in furthering the development of the canning industry, for his organization is constantly at work to develop new and better crops. Just as new machinery and improved equipment are often the result of researches on the part of equipment manufacturers, so likewise are many of the improved varieties of fruits and vegetable attributable to the seed growers' researches.

What the canning industry needs is a good can opener—to paraphrase a famous remark. Without question it will arrive some day. Other indicated developments are the substitute for the tin can, for, with world supplies being rapidly depleted, the price of tin may some day be prohibitive. There is a possibility that an enameled steel sheet may replace the tinned sheet as the basis for can manufacture. Other possibilities are alloys of a non-corrosive nature, but these are probably still further from being commercially practicable than the tinless steel container. Effective methods of automatic soldering or brazing must be developed in parallel with the cheap material.

A complete understanding of the sources of heat-resistant spoilage bacteria will probably lead to methods whereby they may be excluded from the foods about to be sterilized, so that when they are processed temperatures much lower may be used than are now employed, and the result will be an improvement in quality.

Summary

Few industries embrace such a widespread range of human activity as the canning industry. The present-day dependence on research for industrial life itself is not better exemplified than it is here, in an industry that is exceptionally well organized into state, regional, and national associations. State associations, primarily commercial groups, frequently obtain research assistance on all phases of canning technology from their respective state experiment stations, such as those of Indiana, Illinois, California, Massachusetts, Maryland, New York, and Washington.

F. F. Fitzgerald

The National Association maintains its own research laboratories in Washington, D. C., Seattle, Washington, and San Francisco. Also, by grants of money it subsidizes research at large universities such as Harvard, Chicago, and Stanford. Efficient and admirably equipped research departments are maintained by the American Can Company and by the Continental Can Company, to study the needs of canners.

A few of the largest canning companies maintain their own research departments, but ordinarily private researches are seldom published. To mention a few the following corporations are named: California Packing Corporation; Campbell Soup Company; Libby McNiell & Libby; H. J. Heinz Company; Snider Packing Company; Minnesota Valley Canning Company; Van Camp Packing Company; W. R. Roach Canning Company; and Hawaiian Pineapple Company. Most of the corporations engaged in canning, however, contribute to the laboratories of the national association.

ABSTRACTS · OF · CURRENT · LITERATURE

ANEMIA. F. S. Robscheit-Robbins et al. *Journal of Biological Chemistry,* Vol. 79, Oct. 1928, p. 563. Apricots are potent agents in the regeneration of blood in anemic animals. The ash of the apricots retains most of the potency. The ash of beef liver and pig kidney contains about one-half the potency of uncooked liver or kidney. The ash of pineapple is but slightly potent.

* * *

TREATMENT OF RICKETS WITH IRRADIATED ERGOSTEROL. S. Karelitz. *Proceedings of the Society of Experimental Biology and Medicine,* Vol. 25, p. 576. Oct. 1928. The average time for x-ray evidence of healing to appear is 21 days, and for complete healing six weeks plus. The author concludes, "It is hoped that our dairies will be requested either to irradiate the milk, or, preferably, to add irradiated ergosterol, so that we may use this newer knowledge to advantage in attempting prophylactically to prevent the extensive occurrence of rickets."

* * *

DENTAL CARIES. *Lancet,* Nov. 3, 1928, p. 932; editorial. The work of many and various investigators has shown the importance of the relationship between proper food and good teeth. Dental caries, or decay of the teeth, has resulted in many cases from a deficiency of vitamin D and minerals in the diet. The editorial concludes: "At any rate the possibility should not be overlooked that a deficiency of calcium may exist alongside a deficiency of vitamin D in our own diet, so that an attempt to make a small increase in both these factors might be the most practical means of dealing with the problem."

* * *

RAW CANE JUICE. Eugene Loumeau *Sugar* 30, 491-3, Nov., 1928. A more thorough study of cane juice preservatives seemed needed than the usual observation of glucose ratio for a day or two. Toluene, $HgCl_2$, formaldehyde and basic lead acetate were tried, in fresh cane juice, and the actual sucrose loss was measured over a period of a month. It is concluded that, subject to further experimentation, all these suffice to sterilize the raw juice for much longer than is needed in the routine of chemical control. In the undiluted juice, e.g. crusher juice, the sucrose loss in presence of basic lead acetate is less than 0.1 per cent; with $HgCl_2$ the loss may be over 0.1 per cent, but is less than 0.2 per cent; with toluene it is usually between 0.2 and 0.3 per cent, the period being twelve hours in each case, one sample having been taken and preserved hourly in that period. It appears that such loss as does occur is due to enzymes in the juice; inversion due to the natural acidity is negligible.

* * *

THE CALCIUM OF CHEESE. K. Blunt and E. Sumner. *Journal of Home Economics,* Vol. 20, Aug. 1928, p. 587. Two types of cheese have been investigated: the "sour-milk" type (such as cottage cheese) and rennet cheeses, which include most others. Analyses of a number of samples of cheese for their calcium content give the following results: Swiss, 1.05 per cent; cheddar, 0.71 per cent; cottage cheese, 0.077 per cent. The protein content was found to be for Swiss, 31.2 per cent; for cheddar, 25.1 per cent; for cottage cheese, 12.5 per cent. Therefore, cottage cheese, unlike hard rennet cheese, must be regarded as a poor source of calcium, not a rich one, as usually considered.

* * *

EFFECT OF ALUMINUM ON GROWTH. V. C. Myers and J. W. Mull. *Journal of Biological Chemistry,* Aug. 1928, p. 605. Animal feeding tests were conducted to determine the effect of the addition of aluminum to the diet. Minute traces of aluminum are present in the tissues normally, and these show only a slight increase on a diet containing considerable aluminum. Aluminum persists in the tissues, even on an aluminum-free diet. The growth curves of aluminum-fed animals showed a slightly greater initial growth than those of the controls; otherwise the addition of aluminum to the diet was without influence.

* * *

BAKING POWDERS. R. M. Ladd. *Canadian Chemistry & Metallurgy,* Nov., pp. 308-9. In standard practice, a household baking powder must yield about 14 per cent of its weight in CO_2 gas. If a single acid agent is used, there is only one permissible ratio and it can be readily calculated from the chemical equation. The amount of starch added as a buffer must be not less than 20 per cent and must be sufficient to reduce the CO_2 yield to the required 14 per cent. For practical reasons, the only acid agent used alone in baking powders is phosphate; cream of tartar is too weak to be used alone, and alum is too slow in its gas evolution. This property gives alum the advantage of excellent keeping qualities in a baking powder; it does not react with the soda until heated. Of the three types of commercial baking powders, the phosphate and tartar powders are limited to one effective composition; but the alum-phosphate powders may vary all the way between the all-alum and the all-phosphate limits. The fight over the relative merits of alum and phosphate is not yet settled; but from practical considerations, the ideal composition is one in which just enough phosphate is used to release, in the cold, all the gas the fresh dough can be expected to retain. To this enough alum is to be added to bring the total gas yield to the required 14 per cent.

* * *

BACTERIA IN BUTTER. Otto Rahn and H. H. Boysen. *Journal of Dairy Science* 11, 446-70, Nov., 1928. Churning sterilizes the moisture in cream to a considerable extent. This is because the dispersion of the water into fine droplets produces many droplets containing no bacteria. This effect retards acid formation in butter, but not to the full extent represented by the proportion of sterile moisture to infected moisture. It appears that there is some diffusion of acid formed in infected droplets to sterile droplets. To minimize bacterial deterioration of butter, sweet, pasteurized cream should be churned under the best possible approach to sterile conditions, and worked as much as possible without making it salty.

* * *

HEATING CANE. Cecilio Alincastre. *Sugar* 30, 524-5, Nov., 1928. Heat sterilization of cane before cutting is designed to prevent the decomposition and sucrose loss due to bacteria, fungi, and enzymes. The method is to burn the cane just enough to burn away the dry leaves; this bursts and kills the cells in the cortex, and kills the cane. There is some escape of the relatively low-grade cortex juice, which causes a slight increase in amount and decrease in quality of the first pressing of juice. There is some dispute as to whether the burned cane should stand a while or be cut immediately. The evidence is that it should be cut at least within 36 hours. Subsequent operations are easier with burned cane so that there is a saving in labor and other costs.

* * *

EVAPORATED MILK. Byron H. Webb. *Journal of Dairy Science* 11, 471-8, Nov., 1928. A small percentage of low-grade milk added to good milk will either increase or decrease the heat stability: there is no method for predicting which. Similarly, change in pH of a single sample by bacterial action may increase or decrease the heat stability. Apparently every milk has its own optimum pH with respect to heat stability. This is important in the production of evaporated milk, for which optimum heat stability should be provided to prevent coagulation during evaporation. Mixed herd milk is probably usually at its optimum pH when fresh, but sometimes it is not correctly balanced for greatest heat stability for some time after secretion, and the pH should then be adjusted before evaporation.

· CRITICAL · BOOK · REVIEWS ·

TRADE ASSOCIATIONS—The Legal Aspects. By Benjamin S. Kirsh. Comprises 270 pages. Published by the Central Book Company, New York. Price $5.

The modern trade association, when rightly used in fostering the business of its members, is a valuable tool of American industry and one which promises to become increasingly important; but the device is so recent in its application to American business problems that the law with relation to its proper use is still uncertain in some respects. This book attempts to summarize the situation of the trade association with respect to its legal aspects, and is a useful addition to the growing literature on trade association activities.

The volume begins with a discussion of trade association law in general, and discusses its rapid development since the war. Then the author considers various trade association affairs, which have been carefully scrutinized by the courts. He shows what lines of division have been established with respect to clearly legal and illegal forms of collective business activity and takes up such matters as statistics, uniform cost accounting, patent interchange, standardization, and numerous other functions of trade association work. Through it all, one can trace the basic idea that there are many matters of collective activity in which the trade association can engage and which will help the members, individually, more intelligently to guide their respective enterprises. It has not been the object of the law to place a penalty on intelligence and a premium on ignorance. "Elements of co-operation and collective effort to an extent unknown in this country since the enactment of the Sherman Anti-Trust Act already have been welcomed into the law as permissible activities. The rigor of the entire anti-trust system has been relaxed to an unprecedented degree"—to quote from the book one result of trade association law interpretation rendered by the courts.

The trade association is playing an important rôle in non-ferrous metal activities, and to any one interested in the general subject of trade association activities this book will prove helpful.

F. E. WORMSER.

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PATENTS, LAW AND PRACTICE. Fourth Edition. By Oscar A. Geier, of Richards and Geier, patent attorneys, 274 Madison Ave., New York. Copy free on request. Pages 46.

This volume represents a complete revision of the third edition, which appeared in 1924. Since then a great many changes are said to have been made in the rules of practice of the U. S. Patent Office, all of which are taken note of. The contents include a digest of patent law and practice; a description of the procedure in the Patent Office; a discussion of so-called interferences, reissues, appeals, disclaimers, infringements, and suits arising thereupon; interfering patents; and various other topics. The nature of and the procedure to be followed in obtaining foreign patents is also covered.

· GOVERNMENT · PUBLICATIONS ·

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from Bureau responsible for its issue.

Competition and Profits in Bread and Flour. Senate Document No. 98, 70th Congress, First Session. Available from the Federal Trade Commission. Final report of the Federal Trade Commission dealing with conditions in the bread-baking industry, giving results of investigation made in response to Senate Resolution 163, 68th Congress, First Session. This is the third volume transmitted pursuant to this resolution of the Senate: The first volume, "Competitive Conditions in Flour Milling," was printed as Senate Document 97, 70th Congress; the second, "Bakery Combines and Profits," was published as Senate Document No. 212, 69th Congress.

Food Manufacturing Statistics. Census of Manufactures mimeographed preliminary statistical summaries on returns for the calendar year 1927 for the following commodities: Ice Cream; Flavoring Extracts and Flavoring Sirups; Manufactured Ice; Confectionery; and Peanuts, Walnuts, and Other Nuts, Processed.

Statistics of Fats, Oils, and Oleaginous Raw Materials. U. S. Department of Agriculture Statistical Bulletin 24. Fifteen cents. A number in the regular series of publications dealing with this subject, in general giving statistics through 1926 only, but in a few cases including data for 1927. This document is a convenient composite of statistics which are currently available for later periods, except that they are somewhat less complete and are in fragmentary form.

Making Vinegar in the Home and on the Farm. U. S. Department of Agriculture Farmers' Bulletin 1424. Five cents.

Market for Dried Fruit in the United Kingdom, by R. S. Hollingshead. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 592. Ten cents.

Phosphate Cleaner. United States Government Master Specification for Trisodium Phosphate, Technical (Phosphate Cleaner). Bureau of Standards Circular 369. Five cents. Of interest to purchasing agents who may wish to specify quality and performance of purchases of this commodity.

Analyzing Wholesale Distribution Costs, by J. W. Millard. Bureau of Foreign and Domestic Commerce Distribution Cost Studies No. 1. A general summary indicating the methods of analysis used by the Department of Commerce.

The Wholesale Grocer's Problems—Costs, Customers, and Commodities, by J. W. Millard. Bureau of Foreign and Domestic Commerce Distribution Cost Studies No. 4. Of interest to those concerned in the merchandising problems of the food industries.

Improved Apparatus and Method for Making "Shellings" of Rough Rice, by W. D. Smith. U. S. Department of Agriculture Circular 48. Ten cents. Reports investigation and indicates reasons for the recommendation of a mechanical test for appraising the commercial value of rough rice and its millability.

Fermented Milks, by L. A. Rogers and W. R. Albus. U. S. Department of Agriculture Department Bulletin No. 319. Five cents. A résumé of the present knowledge of this subject, including precise technical description of the methods of preparation and distinctive properties of the various kinds of fermented milk marketed commercially in the United States.

United States Census of Agriculture, 1925—Summary Statistics by States, Final Figures. Pamphlets issued by the Bureau of the Census. Twenty cents.

The Growth of Manufactures, 1899 to 1923, by Edmund E. Day and Woodlief Thomas. Bureau of the Census Monograph VIII. $1.35. A valuable reference book for those desiring to study economic or business trends in the various branches of the manufacturing industries.

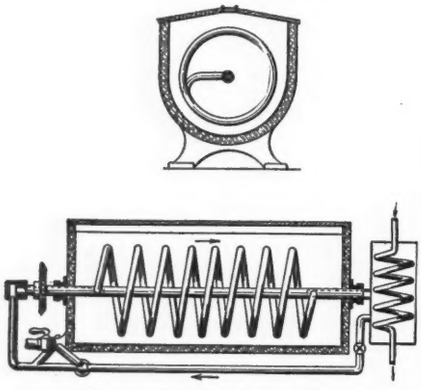
Relation of Kernel Density to Table and Canning Quality in Different Varieties of Maize, by C. W. Culpepper and C. A. Magoon. U. S. Department of Agriculture Technical Bulletin 97. Five cents. Report of experimental studies on the measurable properties which may be applied in the gaging of commercial value and palatability of various types of corn. The data are presented as an aid to an understanding of the relation between preference for table use and the properties of wrinkled, flinty, waxy, and floury types of kernel, respectively.

· SELECTED · PATENTS ·

Milk Pasteurizer

William Sangster, Peterborough, Ont., Canada, assignor to the DeLaval Separator Company, New York. No. 1,694,452. Dec. 11, 1928.

A horizontal type of milk pasteurizer whose walls are insulated and in which the heating of the fluid is accomplished by means of a pipe bent in the form of a worm which rotates and stirs the contents as well as imparts heat. An important feature of the apparatus is the



Non-pocketing pasteurizer

milk outlet, which is so devised that it will avoid forming a pocket in which unpasteurized milk may accumulate during the pasteurizing process and recontaminate the whole batch. This is accomplished by placing the valve close to the receptacle itself and having the short outlet tube provided with a jacket so that it in itself becomes a small pasteurizer. The shape is flared so that milk being thus heated in the outlet will circulate back into the main portion and thus avoid overheating in this particular spot as well as insure pasteurization.

Composition for Treating Fruit

H. G. Zellner, Fort Meyers, Fla., assignor to Zeltrocide Chemical Corporation, Lakeland, Fla. No. 1,696,703. Dec. 25, 1928.

In the citrous fruit industry the fruit is usually washed, dried and polished preparatory to shipping to the market. In these operations some of the fruit becomes scratched or the skin damaged so that blue mold, green mold, and other forms of decomposition set in, causing substantial losses, as well as shortening the merchantable life of the fruit. The invention covers a method of treatment of the fruit consisting in washing it in a solution of 100 lb. of borax, 20 lb. sodium bicarbonate, and 2 lb. potassium permanganate. By treatment with this solution it is found that citrous fruits may be shipped to markets and held with losses of less than 3 per cent for periods up to 90 days. U. S. Patent No. 1,606,704, by the same inventor, covers another composition consisting of 100 lb. of borax, 20 lb. sodium bicarbonate, 18 lb. sodium carbonate, 2 lb. potassium permanganate and 1½ lb. copper sulphate. It also has the effect of substantially reducing loss by decay.

Apparatus for Harvesting Artificial Ice

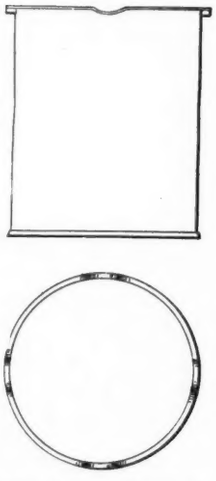
Edward A. Hall, Baltimore. No. 1,694,742. Dec. 11, 1928.

In this patent, the somewhat wasteful process of freeing the cake of ice from the can in which it is frozen is avoided. A method for economizing the refrigeration is described. The tank with its cake of ice is placed in the apparatus, which is hung on trunnions over a receptacle. Water is sprayed upon the sides of the tank and across the top, melting the surface next to the can and freeing the cake. As soon as the cake is free, water runs down between the can and the block of ice, floating it so that the operator may know when to dump it.

Better Method of Vacuumizing Cans

Charles Pickles, San Francisco, Calif., assignor to American Can Company, San Francisco. No. 1,689,641. Oct. 30, 1928.

In the use of vacuum-closing machines at high speed, sufficient time does not always elapse for the evacuation of the air within the container after the time when the lid has begun to seal. In such event, whatever beneficial effect may be induced by the removal of the oxygen is lost. Pickles' invention facilitates the removal of the air from the cans during vacuum canning by providing the edge of the can with indentations which will be ironed out later by the subsequent action of the seaming rolls. The indentations, in reality form temporary ports for the escape of the air.

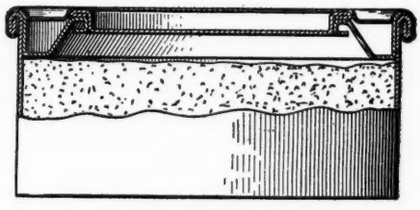


The indentations allow air to escape

Hermetically Sealed Friction Top Can

Albert C. Johnson, Chicago. No. 1,695,286. Dec. 18, 1928.

The closure of this can is most easily described by referring to the illustration. The can is made in such a way that it has a double top, the outer part of which can be opened with a can



Airtight friction top can

opener and thus disclose inside a friction top container. Its purpose, apparently, is to provide an airtight receptacle with a friction cover that can be used after the airtight closure has been removed.

Powdered Chocolate

Wharton B. McLoughlin, New York (Deceased). No. 1,694,391. Dec. 11, 1928.

Under the actual title of "Preparation of Edible Fats" the invention describes a method of producing chocolate in a finely powdered form. This is accomplished by spraying melted chocolate into a current of cold air, the temperature of which is below the solidifying point of chocolate. The resultant product collects in the form of a fine powder which can be stirred into sirup, ice cream mixtures, etc. The process is successful with chocolate containing as high as 30 per cent of cocoa butter.

Decolorizing Vegetable Oils

Harold E. Bierce, Pasadena, Calif. No. 1,696,338. Dec. 25, 1928.

A process for refining vegetable oils in which a sample was obtained having the color of 20 yellow and 1.8 red. Under parallel conditions with the older methods of refining, the same oil gave a color of 30 yellow and 3.0 red. Furthermore, the greater decolorization was obtained with 4 per cent of fuller's earth as compared with 6 per cent in the older methods. The process consists of adding caustic soda to the oil, and agitating. While continuing the agitation, and without allowing any of the foots to settle out, the finely divided earth or clay is added to the oil. The temperature is then raised to a suitable point after which the oil is filtered.

MANUFACTURERS' · NEWS · AND · EQUIPMENT

SEVERAL items of new canning equipment were shown at the machinery exhibit of the Canning Machinery and Supplies Association, held in conjunction with the annual meeting of the National Canners Association. This display is always an outstanding attraction of the convention.

Pressed Nickel Kettles

All-nickel, steam-jacketed kettles, with both shells hydraulically pressed, manufactured by B. H. Hubbert & Son, Baltimore, Md., were shown by the International Nickel Company.

Corn Silker

The corn silker of the Sprague Sells Corporation, Hoopeston, Ill., has been improved by changing the whole plan of the arrangement of the silking wires. In the older models the wires were stationary, arranged in rows across the space through which the cut corn fell. Cleaning the wires in the older models was a manual operation in which the cleaning mechanism was moved along the wires in a longitudinal direction and scraped off the accumulated silks. In the latest model the rows of silking wires are affixed at their ends to two chain belts, and move constantly through the falling cut corn. A rotary brush at the end of the travel frees the wires of silk.

Corn Husker

A new corn husker, the Superhusker, shown by Sprague Sells Corporation, embodies a number of improvements. It gives nearly perfect butting—the operation of cutting the butts from the ears of corn. The operation is one that may be wasteful through cutting off too much of the butt. The Superhusker is a double machine and operates at a higher capacity than the older models.

Continuous Pressure Cooker

A laboratory model, weighing *nine tons,* of the latest A-B continuous pressure cooker and cooler, embodies so much that is new that *Food Industries* will describe it in detail in a future issue. It is a gift to the Continental Can Company.

Power-Operated Can Opener

A new can opener, power operated, is a new offering of the Sprague Sells Corporation. Its principle is to rotate the can against a stationary knife, which cuts the cover inside the rim of the can. The knife presses the rim of the can against a power-driven knurled roller.

Vertical Speed Transmission Units

A vertical Reeves variable-speed transmission unit to perform the same function as the more common horizontal type was shown by the Reeves Pulley Company, Columbus, Ind. The vertical design is for use in places where floor or ceiling space is at a premium.

Semi-Automatic Filler

The labor of one or two operators is saved by the Haller model E-7 rotary gallon jug filler, which is also available for filling No. 10 cans. Containers are fed to the machines by hand, travel around the circle, are filled, and discharged automatically without overfill.

Sealing Compound and Its Application

The Dewey & Almy Chemical Company, Cambridge, Mass., has developed a new machine, suitable for small shops, for applying the company's Gold Seal sealing compound to can ends. It is named the Gold Seal semi-automatic lining machine. Round, oval, and rectangular ends may be lined on it.

Gold Seal cap compound was displayed for the first time for closures for glass as a better gasket for such containers. It is applied to the caps in liquid form in special machines and when dry forms a continuous effective rubber gasket that will not fall out.

Automatic Sealing and Filling

Automatic top and bottom sealing and filling of cartons was demonstrated by the new double sealer of J. L. Ferguson Company, Joliet, Ill. It forms the carton, seals the bottom, measures and fills the carton with a granular product, and then seals the top. An important feature is the no-carton-no-fill device that prevents spillage if the cartons are fed irregularly.

Cabbage Trimmer and Corer

An automatic cabbage-coring machine, manufactured by the Kraut Machinery Company, Pittsburgh, Pa., embodies an overhead motor and drive, and rotary coring knives, revolving on vertical sprindes and mounted on a revolving head. Cabbage heads are placed in the four receptacles on a table revolving in unison with the head that carries the coring knives. Suitable cams start the knives in motion, lower them through the cabbage, reverse the motion, raise the knives, and stop their rotation when the cabbage head is discharged and a fresh head is placed in the receptacles by the operator. An important feature is the fact that the knives are at rest when they are passing the operator, a condition lessening the possibility of accident.

Semi-Automatic Box Sealer

A four-station box sealer, the Harmon Sealer, was exhibited by James H. Jones, Chicago, Ill. Its outstanding features are the easy release of the pressure lever, and the construction of the pedestal, which causes it to tilt toward the operator the moment pressure is released.

Monel Metal Utensils

A complete line of Nesco Monel metal utensils, manufactured by the National Enameling & Stamping Company, of Milwaukee, Wis., were on display at the booth of the International Nickel Company. The exhibit consisted of pails, dippers, pans of various sorts, with metal of from 20 to 26 gage, depending on the type of utensil.

Vacuum Pan Heater

An interesting heating unit for a vacuum pan was on display by the Glascote Company, Euclid, Ohio. In addition to having an acid-proof, glass-lined, steam-jacket body, it also contains glass-coated steam coils of the same material. The coil consists of a seamless steel tubing curved into the usual helical form and coated with the same acid-resisting glass. The glass coating of the metal has been adjusted so that its coefficient of expansion is identical with that of the metal base, thereby avoiding chipping caused by uneven expansion and contracting, even though steam under considerable pressure is admitted to the coil.

Universal Filler

A universal single-valve filler with interchangeable cylinders was one of the new offerings of the Elgin Manufacturing Company, Elgin, Ill. It is a moderate priced filler with a speed of 25 containers per minute and is adjustable from 0 to 72 oz. fill per stroke. When supplied with automatic feed it is equipped with a lifting device for bottom filling of containers, a feature particularly desirable when filling heavy products such as mayonnaise.

Replaceable Caps

A new type of Goldy seal has been developed by the Aluminum Corporation of America. It embodies all of the characteristics of the previous Goldy seal, but in addition possesses lips on the caps proper which hold it in place

after the band has been broken. These permit the caps to be used in replaceable fashion, a feature desirable in the household, where the contents of a bottle or jar may be only partly used when it is first opened.

Automatic Self-Cleaning Corn Silker

Removal of the last bits of the silk from the cut corn after it has been mixed with sirup is usually accomplished by dropping it through a series of fine wires which capture the silk but allow the corn to fall through. The wires soon become clogged with silk, and their cleaning is done in various ways. The Berlin Chapman Company places the wires radially in a large revolving circle, the outer ends of which are free. The wires extend outward from a circular framework. The silker revolves intermittently, bringing the silk-covered wires before a powerful spray of water that washes the silk off the outer ends of the wire into a receptacle, from which it may be collected.

Washer Elevator

One of the latest developments of canning equipment is the washer elevator, shown by the Scott Viner Company, Columbus, Ohio. This is a means of conveying and elevating peas by means of a stream of water flowing through a 4-in. pipe. On first inspection it appears to be a method of pumping peas: the peas are not pumped, however; the water only is pumped.

The essential feature of the washer elevator is its method of introducing the peas into a stream of water moving under pressure without injury to the peas themselves. This is accomplished by allowing the peas to fall by gravity into each of the five pockets of a rotary valve, which moves by intermittent motion. Movement of the valve through two stations places the charge of peas at the bottom of a 4-in. discharge pipe. At the bottom of the valve a stream of water enters, forcing the peas upward, together with the air entrapped in the valve.

The valve pocket is now full of water, which is removed by a second pump at the fourth station. Air now fills the pocket, and at the fifth station peas again fall into the pocket, and the process is repeated.

The surge of water and air thoroughly washes the peas and keeps them in suspension. The delivery pipe can be led around as many tortuous bends as required, and the limiting height to which peas may be thus hydraulically elevated is governed only by the pressure which the rotary pumps are capable of delivering.

In connection with the washer elevator, a new type of rotating screen is equipped with corrosion-resistant wires, circumferentially placed. This screen permits the passage of splits and skins, but detains the whole round peas.

Oscillating Batch Corn Mixer

To avoid cooking corn on the sides of the mixing equipment in sweet corn canning, the Berlin Chapman Company, Berlin, Wis., has introduced a new type of mixing device. The older forms employ a revolving stirrer of hollow tubing through which steam is shot into the corn and sirup in order to preheat them. The inevitable splashing of the mixture onto the hot sides of the mixer is now avoided by the oscillating motion of the stirrer, which is accomplished by a bell crank drive outside the tank proper. Steam is introduced only into the lower segments of the stirrer.

Seamers, Slitters and Edgers

Among the new can-making machines shown at the convention for the first time were three from the Adriance Machine Works, Brooklyn, N. Y. The 119 D rotary double seamer equipped with end feed seaming and curbing heads operates up to 200 cans per minute and has a variable capacity up to a 1-lb. coffee can.

The No. 283 gang slitter is equipped with disappearing gages for decorated stock and spring tension feed rings.

For notching and double edging body blanks the Adriance Company provides No. 144 double edging machine equipped with notching attachment. It is capable of adjustment through a wide range of sizes up to 14x28 in.

Proportioning Corn Mixer and Heater

A large number of machines are available for mixing cut corn with sirup and subsequently heating it preparatory to canning. One of the most recent developments is the proportioning corn mixer and heater offered by the Berlin Chapman Company. The principal features of this machine are its automatic measuring pumps, which are adjustable while the machine is in operation, making possible absolute control of the volume of cut corn, sirup, and added water. The three pumps discharge their respective contents into a heating cylinder just below, equipped with a revolving mechanical stirrer. The latter has perforated hollow arms through which steam is blown to heat the corn.

Complete control of the proportions of each constituent and the amount of preheat necessary is obtained by adjusting the stroke of each pump, the rate of steam flow, and the speed of the machine itself.

Liners and Double Seamers

The Max Arms Machine Company, Bridgeport, Conn., showed an automatic square can end liner and shelf type drier for lining ends for square cans with rubber compound; also its new square can double seamer, for closing square asparagus cans, meat cans, and similar types of square cans. The unique feature of this form of closing machine is the clover-leaf-shaped rolls, as contrasted with the round rolls of other types of this equipment.

Adjustable Pea and Bean Filler

A new pea and bean filler has been placed on the market this year by the Hansen Canning Machinery Corporation, of Cedarburg, Wis. Its chief features are separately adjustable devices for measuring the peas or beans, and the brine or bean sauce. This method of filling measured amounts of the products to go into the can prevents overflow of brine, and avoids the necessity of using rubber gaskets to insure a tight seal. By filling the peas or beans first, and then following with liquids, all splashing is avoided. Another feature is a stop device that disengages the clutch if a can is missing and stops the machine.

Fibre Hand Portable Light

A non-conductive, shock-proof, fibre hand portable, with adjustable hook. Equally well suited for use in homes, factories, garages, and on telephone and power switchboards. Although weighing only 8 oz., it is sturdily constructed, and will withstand the weight of a 180-lb. man without injury to the lamp. A special floating socket and four flexible springs protect the lamp from mechanical jars and breakage, and absorb shocks that would otherwise be transmitted to the lamp filament. A feature is a fibre half-shade which directs the light rays on the work and out of the user's eyes. This portable will take lamps from 25 to 60 watts. It is manufactured by the Benjamin Electric Manufacturing Company, Chicago.

Modern Baking Analyzed

"The Baking Industry, a Market Analysis," by *Bakers Weekly*, a leading trade paper published in New York and Chicago, is replete with current statistical material, attractively presented and comprehensively interpreted. To those primarily interested in the economics of commercial bread baking the chapters discussing its growth, its internal characteristics and changes, and its present organization will probably prove of greatest interest; to the manufacturers of baking equipment the rest of the book may be of greater value, although all of it is of more than ordinary worth.

· NEWS · ITEMS ·

Casein Tariff Revision Complex Problem

WHEN the coated-paper manufacturers attacked the existing duty of 2½c. a pound on imported casein before the House Ways and Means Committee in Washington on Jan. 8, stiff opposition was elicited from the dairy interests, which demanded an increase from 2½c. to 8c. Though urging the placement of casein on the free list, the coated paper interests indicated that they need a protection of 4c. per pound on their own product.

W. S. Moskrip, of Lake Elmo, Minn., spoke for the National Co-operative Milk Producers Association, with its 365,000 dairy farmers and 45,000 producing organizations. He stated that imports of foreign casein had forced the domestic price down to a point low enough to discourage production in the United States. He estimated that an 8c. duty would increase the returns to the domestic producer by ½c. per quart of skim milk. In Argentina, he showed, the producer of milk had received only 96c. a hundred pounds, or 2c. per quart, and he stated that the proposed increased tariff would be largely for the purpose of equalizing costs of production. Spokesmen for the coated-paper manufacturers claim that domestic producers cannot supply the demand for casein of proper quality on account of the increasing use of milk for evaporated and powdered milk.

From Buenos Aires comes another angle to the story in cabled dispatches to the effect that the casein industry of that country will face ruin if the American tariff is raised to 8c. Argentine supplies two-thirds of the casein used in international trade. In good years the production is 20,000 tons, of which the United States uses 12,000 tons. The Argentine Dairyman's Association claims that domestic United States production cannot be more than 8,000 tons annually. Apparently the fear is entertained that a large industry may develop in the United States if a high tariff is imposed.

Golden State Expands

The Golden State Milk Products Company, of San Francisco, one of the three largest milk products companies in the United States, has added some 3,000,000 gal. to its annual production through the purchase of the Walnut Grove Creamery. The purchasing concern has acquired fifteen independent companies in California during the last year, its assets having more than doubled. Its activities include manufacturing and distribution.

Kelly Dry-Pure Juice Corporation Sold

The Kelly Dry-Pure Juice Corporation, New York, which operates under the much discussed Matzka process, has been sold to the Shewan group, New York and San Francisco, which also controls the National Ice & Cold Storage Company, of California. It is understood that a corporation, to be known as the Matzka Products Corporation, will be formed to absorb the control of the Kelly company. The new concern will have plants in New York City, and Lodi, Calif.

Smoked Salt in Baking

Biscuit and cracker manufacturers are experimenting with smoked salt as a new flavor in special pieces.

COMING EVENTS

FEBRUARY

4-5—Tennessee Association of Bottlers of Carbonated Beverages, Chattanooga.
5-6—Annual Convention, Tennessee Canners Association, Knoxville.
6-7—California Bottlers' Protective Association, Los Angeles.
7-8—Alabama Bottlers' Association, Birmingham.
11-12—Mississippi Bottlers' Association, Gulfport.
11-12—Kentucky State Bottlers' Association, Paducah.
11—Michigan Allied Dairy Associations, Kalamazoo.
11-13—Indiana Bakers Association, Indianapolis.
13-14—North Dakota Bottlers' Association. Jamestown.
14-15—Washington State Bottlers' Association, Seattle.
14-15—West Virginia Bottlers' Association, Charleston.
19-21—Cake Conference, American Bakers' Association, Chicago.
20-21—Ohio Bottlers' Convention, Columbus.
22-23—Utah State Bottlers of Carbonated Beverages, Ogden.
26-27—Colorado Bottlers of Carbonated Beverages, Canon City.
27-Mar. 2—Canners League of California, San Francisco.

MARCH

Feb. 27-2—Canners League of California, San Francisco.
6-7—Michigan Bottlers of Carbonated Beverages, Grand Rapids.
8-9—Annual Convention, Utah Canners Association, Ogden.
13—Dairy Products Association of Kentucky, Louisville.
25-28—National Convention, American Society of Bakery Engineers, Chicago.
26-28—Kansas Bakers Association, Wichita.

APRIL

16-17—Illinois Bakers Association. Joliet.
29-May 3—American Chemical Society, Columbus, Ohio.
—American Dry Milk Institute.

MAY

5-7—Southern Bakers Association, New Orleans.
6-10—American Association of Cereal Chemists, Kansas City, Mo.

Standard Milling Company Increases Capital

STOCKHOLDERS of the Standard Milling Company, owner of seven large subsidiary corporations, have authorized the increase of common stock from $15,000,000 to $25,000,000. The shares have a par value of $100 each. It is proposed to issue $6,246,800 new stock at par to stockholders on the basis of one new share for two old shares. The proceeds will be used to retire the 5 per cent first-mortgage bonds and notes, leaving a funded debt of $2,275,000, which will be retired within the next few years. When the transactions are completed, the common stock outstanding will be $18,740,500.

Gold Dust Corporation recently purchased 40,000 shares of Standard Milling Common and is now extending an offer to shareholders of the company to exchange their securities on the basis of one new share of $6 cumulative convertible preferred stock of Gold Dust for one share of 6 per cent non-cumulative preferred stock of Standard Milling, which has been selling at from $120 to $130 a share; or two shares of Gold Dust common for one share of Standard Millings common, which has had a recent market value of approximately $160 a share. Gold Dust common has been selling for values in the neighborhood of $80 a share.

Simultaneously comes the announcement from Gold Dust of the retirement of its present preferred stock and issuance of a new preferred with privilege of conversion into common at the rate of 1½ of the latter for each preferred share up to Dec. 31, 1930; into 1¼ of common up to Dec. 31, 1932; and into one of common until Dec. 31, 1934. The preferred will be non-callable prior to Jan. 1, 1932.

Errata

Dr. Carl R. Fellers, Director (pro tem) of Laboratory and Research of the Hills Brothers Company, has been granted eight months' leave of absence from the Department of Horticultural Manufacturers of the Massachusetts Agricultural College, Amherst, Mass., and has not resigned, as was erroneously reported in our last issue.

On page 159 of the January issue of *Food Industries* David Wesson's informal discussion of preservation in the fats and oils industry contained a statement to the effect that the presence of small quantities of free oleic acid would stop decomposition in fats. The fact is that such acidification will start decomposition, not stop it—a slip of the pen for which we are extremely sorry.

Sugar Occupies Center of Stage in Tariff Discussion

By Paul Wooton
Washington Correspondent

SUGAR appears to be faced with increased duty. It is not believed that Congress will be willing to vote the $2.40 per 100 lb. asked by the domestic industry against imports from Cuba, but the general feeling on Capitol Hill is that there will be an increase over the present rate of $1.76 per 100 lb.

The sugar schedule is certain to be one of the storm centers of tariff revision. Domestic interests are seeking to make the duty effective against sugar from the Philippine Islands, as well as against Cuba. The proposal that a maximum of 500,000 tons be allowed to come in from the Philippines free of duty seems to be losing favor. Constitutional objections have been raised; further, it was looked upon as establishing a precedent which might be applied to Cuba—in fact a plan for the admission of 3,000,000 tons of Cuban sugar free has been brought forward by those interested. Apparently, however, the American consumer is not willing to hold the bag while Cuba turns its entire attention to the fighting of Javanese competition in the rest of the world.

Sliding Scale Suggested

Several propositions have been brought forward for alternative methods in the levying of the sugar duty. One of them suggests a sliding scale such as that which has operated successfully in Germany. Under that plan the rate of duty would be decreased as the price of sugar advanced, finally going on the free list when raws reached a certain figure in New York. This is attacked, however, on the ground that it is a form of price fixing and that it would be difficult to arrive at a basis for the sliding scale. Also, it is pointed out that the corn laws of Great Britain, employing that principle, failed. Nevertheless, the proposition is regarded sympathetically by both the domestic sugar industry and Congress. If some practical plan could be worked out which would protect producers against low prices and consumers against excessive prices, it would solve one of the great difficulties in tariff making.

There is strong farmer support for increased sugar duties. This is due, in part, to the realization that there must be some consistency in a tariff policy. The farm organizations hardly could advocate high duties on vegetable and animal oils and not support some increase for the domestic sugar industry. In addition, however, serious consideration is being given to the agricultural possibilities, which go hand in hand with the protection of the domestic industry. If a substantial increase in the duty is voted, it is admitted that there will be a rapid expansion in the acreage devoted to sugar cane and sugar beets. This would provide a profitable field in many states for farmers who are anxious to take up crops of which there is no exportable surplus.

Corn sugar, maple sugar, and the various molasses and sugar syrups are certain to come in for corresponding increases. There is particular activity on the part of the farm organizations to give adequate protection for all corn products. Closely related to this campaign is the effort to secure duties on tapioca and sago starches. These commodities, which are produced in large quantities and at low cost in the Dutch East Indies, are declared to be competing importantly with cornstarch. Some objection is being raised to the duty in the industrial field on the ground that cornstarch cannot be substituted successfully for tapioca starch in the finishing and sizing of textiles and in the veneer trade.

Labeling of Dextrose Under Discussion

In connection with the tariff revision activities of the farm organizations and the corn products interests, a determined effort has been made to secure legislation which will preclude the necessity of naming on labels the type of sugar used in jellies, jams, preserves, canned fruits, canned vegetables, and other products. This legislation is being opposed by the Department of Agriculture on the ground that it places in jeopardy an important feature of the Food and Drugs Act—the requirement for truthful labeling. On the other hand it is pointed out that the Department of Agriculture admits the purity, wholesomeness and food value of corn sugar, but it has taken the position that the use of corn sugar in certain products without label mention would result in deception. In that connection, however, the advocates of the legislation call attention to the fact that no labeling is required on products in which oleomargarine is used instead of butter, or when other than olive oil is used in salad dressing. A long list of such examples is offered in the effort to prove that it is a discrimination against corn sugar to require a statement on the label that dextrose is used. Manufacturers of jellies and similar products are on record stating that they would not use corn sugar under such conditions, as many consumers think the product contains a questionable ingredient. It is contended that without this requirement there would be an increase in the use of corn sugar of more than 400,000,000 pounds a year. In the forthcoming legislative fight the domestic cane and beet sugar industries will support the program of the American Farm Bureau Federation, which has embodied therein this particular item.

It also has become increasingly apparent that duties on animal and vegetable oils and fats will entail a bitter contest when the tariff bill reaches the floor. It is safe to say in advance that the 45 per cent ad valorem asked by the farm organizations for all such commodities will not be allowed. The soap manufacturing interests have established that there is a large deficit in the raw materials suitable for soap making. They also appear to have proved to the satisfaction of the committee that many of these commodities are not interchangeable. A particularly good case was made on behalf of cocoanut and palm kernel oils. A spokesman for the soap manufacturing industry contended that the 45 per cent duty sought would increase the price of soap by 50 per cent or more to the consumers and would eliminate the smaller units from the soap-making business. The committee was told that probably about one-third of the existing plants could survive such a tariff, but this one-third would consist of the large units in the business. Deficiency of oils and fats was estimated at more than 1,250,000,000 lb. The feeling in the soap industry is that the farmers have been given the edible market, and since they cannot afford to pay edible prices they should be allowed reasonable latitude in securing their raw materials.

Organic Chemicals and Citric Products

The farm interests are insisting upon protection for chemicals produced from farm products. An example is butanol. In 1928 eight million bushels of corn were used in its production.

Increased duties are being asked on citric acid and related materials. This country formerly depended entirely on Italy for citrate raw materials. A domestic industry has been developed with great rapidity during recent years. Between the citric industries in California and the operation of the fermentation process in the East, the country has been rendered independent of Italy for citric raw materials and citric acid.

Special interest was shown during the tariff hearings in adequate protection for orange and lemon juices, which are now on the free list. The progress which has been made in preparing these juices so as to preserve their natural flavor after bottling makes it important, it is declared, to protect what promises to be an important industry.

Mechanics of Tariff Making May Be Altered

It is apparent that there is strong sentiment for the elimination of the present policy of attempting to secure foreign costs. Already France has forbidden the entry of Treasury agents. Other nations have shown great irritation because of the efforts of the United States to secure production costs. Though the prevailing opinion among tariff specialists is that American valuation will be adopted ultimately, they do not believe that its advocates will be able to write it into

the new law. Under present trade practice, it is pointed out, a vast number of articles pass through the Customs House on which it would be difficult to establish the American selling price.

Manufacturers and Farmers in Agreement

Thus far in the hearings, both manufacturers and farmers have been practically unanimous in their desire to have the flexible provisions of the present law retained in the new act. This section of the law will receive detailed consideration at a hearing scheduled for Feb. 25. Members of the Ways and Means Committee are outspoken in their appreciation of the reports of the Tariff Commission on the different schedules. One member states that the tariff information circulars alone justify the entire appropriation of the commission. It is evident that the committee will rely entirely on the commission for the checking of statements presented and for much of the fact-finding which must be done in connection with the revision of the law.

Fifty Per Cent on Peanuts?

A 50 per cent tariff raise on peanuts is pending before the President in accordance with the terms of the flexible provisions of the present tariff act. This would mean a specific duty of 6c. per pound on shelled nuts and 4½c. on unshelled. In the hearings before the Tariff Commission last July, this increase was urged not only by growers, but also by salters and packers, who felt that Chinese competition would force peanuts out of cultivation in many areas, and thus curtail their supply. Dissenting opinion was given by a few salters, produce brokers, and candy manufacturers, who felt that the increase was unnecessary. As this magazine goes to press, it is confidently expected by the farmers asking relief that the higher rate will be granted.

A large packing company is said to have bought 1,000,000 bags (85 lb. each) of Virginia type peanuts—roughly a third of the available supply. This is said to be in anticipation of duty increases.

In preparation for the tariff hearings before the Ways and Means Committee now in progress, the Virginia and Spanish Tariff Association met in Norfolk, Va., on Jan. 8, and agreed that the duty should be raised to 7c. per pound on shelled and 6c. on unshelled peanuts.

Soap Interests Active

Fats and oils were a center of controversy in the tariff hearings before the Committee of Ways and Means on Jan. 9. If the plea of the farmers is granted as a measure of relief, a uniform duty of 45 per cent ad valorem will be placed on all oils and fats, animal or vegetable, edible or inedible. The present duties vary with the product, but in most cases stand at much less than the proposed rate.

Advocating this change, C. W. Holman, of Washington, D. C.—representing the National Co-Operative Milk Producers Federation, and speaking for a number of concurrent groups for which witnesses appeared later—opened the main discussion. The products on which protection is desired are cotton seed, flaxseed, hogs, corn, peanuts, fish oil, butter fat, and the infant industries of soya beans and tongue trees. It was contended that foreign production of certain of these items threatens American enterprise and that other oils, such as cocoanut oil, palm kernel oil, palm oil, denatured olive oil, and sea animal oil, are competitive to the extent that they are interchangeable.

In opposition, the soap manufacturers were most emphatic, the principal testimony being given by F. M. Barnes, of Cincinnati. According to Mr. Barnes, the 45 per cent duty would increase the price of laundry soap by almost that percentage, thus increasing the costs of general consumers and especially of laundry concerns which have to work at the lowest possible rates in order to attract business still done largely in the homes.

The principal oils imported for the soap kettle are not competitive with American products, Mr. Barnes stated, since they are necessary to supply a shortage, and since domestic products are not suitable for many of the purposes to which these foreign oils are applied. They are not competitive with cottonseed oil, it was argued, because the domestic supply of that product is used entirely in foodstuffs and none is left for soap. The animal fats from the packers and from butchers and restaurant scraps do not come anywhere near satisfying the soapmakers' demand, according to commercial statistics which are undisputed. Data were submitted to show that many of the oils are not interchangeable and therefore non-competitive.

To protect Philippine cocoanut oil interests, a statement was made by Major General Frank McIntyre, Chief of the Bureau of Insular Affairs, representing the Philippine government. He stated that the duty would be ruinous to the islands by seriously handicapping their second largest industry.

The complexity of the oil tariff problem, both from a technical and an economic standpoint, will make a decision equitable to all extremely difficult, it is pointed out. It is hardly to be expected that a straight duty of 45 per cent on all oils regardless of source or extraction will be accepted to the detriment of industries importing for special purposes without harm to American producers.

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Urging a duty increase on tartaric products, H. M. Hubbard, of the Royal Baking Powder Company, appeared before the Committee of Ways and Means on Jan. 7.

On the grounds of cheap Italian competition, it is desired to raise the rates on tartaric acid from 6 to 9c. per pound and cream of tartar from 5 to 7½c. Wine lees, argols, and other raw materials now at 5 per cent ad valorem were recommended for the free list. Mr. Hubbard brought out that raw material costs average 70 per cent of the finished product and that materials cost 30 per cent less in Italy than in the United States.

Opposing views were presented by Henry Platt whose company uses an eighth of the domestic consumption of tartaric acid in Sal Hepatica. He believed that the revision, if any, should be downward. Free entry of argols and wine lees, which are not produced in this country, would harm no American interests, and should relieve the baking powder manufacturers, thus removing the necessity of an increase on tartaric acid and cream of tartar.

Coffee Congress to Meet Next May

An International Coffee Congress is to be held coincidentally with the Seville Ibero-American Exposition in May, 1929, it is announced. The International Association of Agriculture of Tropical Countries is sponsoring the meeting and is promoting a general tropical and subtropical agricultural assembly at the same time.

Pecan Growers Exchange on Federal Grill

The Federal Trade Commission is proceeding against the Dixie Pecan Growers' Exchange, Inc., on the grounds that the respondents are neither growers nor an exchange. The corporation has been using the slogans "direct from the growers" and "fresh from the groves," whereas in fact it was acting only as a buyer and distributor, it is claimed. Similar cases have been held as unfair trade practice, since consumers buy from an exchange with the idea that they are dealing direct with the producers and avoiding the payment of middlemen's profits.

Cuba's Sugar Crop Approaching Normal

Sugar market conditions are quiet awaiting the Cuban crop report. Since the Cuban restrictive regulation instituted in 1925, production there has steadily fallen from about five million tons to four million last year. Now that the restriction is generally thought to be lifted, this year's output is estimated through the industry as about 4,800,000 tons. The hurricane has helped rather than hindered by supplying needed rainfall in northern Cuba, it is stated. This is said to have more than offset the Porto Rican crop damage. Market conditions are expected to remain more or less stable in the United States. It is not believed that a tariff change, if any, would become effective in time to affect this year's supply.

Means to relieve low sugar prices were discussed at a meeting of the Economic Committee, League of Nations, held in November. Lucius Eastman was the American representative. It is understood that Cuba has for some time been negotiating with Java toward a crop restriction agreement, but that Javan interests would not concur.

Canners Convene at Chicago

Editorial Report
By L. V. Burton

WHAT IS PROBABLY the largest food convention in the country was held in Chicago last month, when eight associations convened simultaneously between Jan. 21 and 26. By custom the whole group of meetings has come to be known as the Canners Convention, owing to the fact that the canners' organization, together with the huge exhibit of new machinery and supplies shown by the members of the Canning Machinery and Supplies Association, dominates the group by its great size.

The eight associations which met in Chicago were the National Canners Association, Canning Machinery and Supplies Association, National Food Brokers Association, National Kraut Packers Association, National Pickle Packers Association, National Preservers Association, Mayonnaise Products Manufacturers Association of America, and the National Wholesale Grocers Association.

Although the mayonnaise group had met in Boston only two months previously, so many of its members were in Chicago for the other meetings that it held formal sessions for the purpose of discussing research and the newly announced government standards for mayonnaise.

E. B. Cosgrove, president of the Minnesota Valley Canning Company, was elected president of the National Canners Association, succeeding Ben C. Nott, of W. R. Roach and Company, Grand Rapids, Mich. H. E. MacConaughey and Leonard E. Wood, both of San Francisco, were elected first and second vice-presidents. Frank E. Gorrell, secretary-treasurer, was re-elected.

Distribution was the outstanding topic of the general sessions. Particular emphasis was given to the proposed amendment to the Food and Drugs Act, now before Congress, and designated as S. 4,800. Discussions of this important proposed legislation by Judge Covington (counsel for the association), James Moore (president, Snider Packing Company), Arthur P. Williams (R. C. Williams & Company, New York), and H. W. Phelps (president, American Can Company) left no doubt as to the desirability of the elimination of the substandard quality of canned foods from free competition with the better grades. There was a feeling, however, that a certain difference of opinion might exist as to the best method of approaching the reform. Mr. Williams held that economic forces were bringing about the elimination of the substandard grade. However, the meetings of the conference committee of the National Wholesale Grocers Association, with the corresponding committee of the Canners Association, developed the fact that both groups were in entire accord. Both associations unanimously endorsed the proposed amendment to the Food and Drugs Act.

The resolution adopted by the Canners Association, endorsing the amendment, was as follows:

"Whereas, The Federal Food and Drugs Act has proved an effective statute which in its present form has been of the greatest benefit not only to the public but also to every honest manufacturer and merchant; and,

"Whereas, For many years we have opposed practically all amendments of this federal statute, believing that such amendments would create confusion and weaken the law and impose unnecessary and costly burdens on consumers, distributors and packers; be it

"Resolved, That we oppose any special amendments of the Federal Food and Drugs Act except in the case where such an amendment may be advisable to prevent the sale of foods that are inferior or below standard under deceptively appearing labels, and we therefore heartily endorse in principle the object of the McNary-Mapes canned foods bill now pending in Congress."

In addition to the speeches and addresses on distribution there were many technical papers and reports of research that are of interest to operating men in all branches of the food industries.

Well-Organized Industry

THE ASSOCIATIONS which met in Chicago Jan. 21-26 present a formidable list. Here it is: National Canners Association; Canning Machinery and Supplies Association; National Food Brokers Association; National Kraut Packers Association; National Pickle Packers Association; National Preservers Association; Mayonnaise Products Manufacturers Association of America; National Wholesale Grocers Association.

Mobile Field Laboratory of the National Canners Association

In order to ascertain promptly the locations of all factories in which spoilage of canned foods caused by flat-sour and other thermophilic bacteria is a potential menace, the National Canners' Association maintains a mobile laboratory mounted upon a motor truck. Three bacteriologists, an engineer and a helper comprise the staff, the work of which was reviewed by Dr. E. J. Cameron, who has been in charge of this phase of the field operations. Dr. Cameron pointed out that commercially sterile canned corn is not absolutely sterile. Commercial sterility means that the product will keep as long as its temperature does not go above 100 deg. F., although living spores of obligate thermophilic bacteria may be present and able to cause spoilage if the temperature goes above 100 deg. F.

The belief that absolute sterility is not possible by processing alone was expressed by Dr. Cameron, who stated that it could be accomplished only by eliminating the contamination of canned corn by these extremely heat-resistant organisms. To concentrate on this phase of the problem is the purpose of the association during the 1929 pack. Whether or not their objective may be a possibility is to be settled as quickly as possible. If it is shown to be a scientific possibility, the technique will be worked out in succeeding years.

State Grading of Canned Foods in Wisconsin

The old and perplexing problem of grading canned foods has long been subject to arguments for and against the absolute system of grading. H. R. Burr, secretary of the Wisconsin Canners' Association, is a believer in the absolute fixed grade, and advocates strict adherence to a rigid classification. He explained in detail how the Wisconsin Department of Markets adopted the rigid grading system and was able to grade 1,500,000 cases of peas, 100,000 cases of corn, and 60,000 cases of beans before Nov. 1, 1928—a noteworthy achievement in so young a development. The cost of this grading, which is done only on the request of a subscribing canner, was $1.50 per thousand cases.

Labeling Substandards

OUTSTANDING among the accomplishments of the canners' convention was the unanimous endorsement of the McNary-Mapes bill to amend the Food and Drugs Act in such a manner as will require designative labeling of substandard canned foods.

In 1929, the increased number of those desiring to avail themselves of the state grading will permit a decrease of cost to $1 per thousand.

Influence of Foreign Beans on Domestic Price

The world sources of beans of many descriptions and varieties was discussed by Bruce A. Stickle, of Chatterton & Sons, bean dealers, who explained the influence of foreign beans on the price of Michigan pea beans. Canners of this variety of bean are often perplexed by the prevailing prices. Mr. Stickle discussed fully the many conditions governing trade in foreign beans, so that any who cared to import beans of the same variety, or of substitute varieties, might be in full possession of the facts. He also pointed out that those who prefer to pack domestic beans are now presented with the opportunity of having the tariff increased from $1.75 to a possible $2.50 per 100 pounds.

Rules Laid Down for Retort Management and Cooling

Inasmuch as commercial canning does not always result in total sterility, the canner must be on constant guard against a possible infection of his product with spores of thermophilic bacteria. If these are present in large number it is highly probable that the usual process, or "cook," may not kill all of them, although all other forms of bacteria will be destroyed.

Fortunately, however, canned foods will not spoil, if after cooking they are properly cooled to a temperature below 100 deg. F. When proper cooling is done the cans will keep indefinitely, whether thermophilic bacteria are present or not.

R. J. Thompson, mechanical engineer of the research laboratories of the association, pointed out that many establishments are failing to use the greatest efficiency possible for cooling cans in their tanks of cooling water. He recommended the counter-current flow of hot cans and cold water in the tank; also that crates of hot cans should be submerged below the surface of the water as far as possible. A good plan is to have the hot water overflow the top of the cooling tank into a gutter along the side, so that it may be effectually removed from all possibility of mixing with colder water below.

The great importance of bleeding the air from a retort, in the early stages of the process, was also stressed by Mr. Thompson, who felt that plants whose retorts were not equipped to accomplish this air removal quickly were lacking in adequate facilities. The importance of bleeding steam from the thermometer pocket at all times was emphasized as decidedly necessary if an accurate thermometer reading is to be obtained. He was of the opinion, however, that after all the air is removed from a retort, by proper preliminary bleeding, there is no advantage to be gained by wasting steam through further bleeding.

Canners' New Officers

HERE are the new officers of The National Canners Association who will serve in 1929: President, E. B. Cosgrove, Le Sueur, Minn.; first vice-president, H. E. MacConaughey, San Francisco, Calif.; second vice-president, Leonard E. Wood, San Francisco, Calif.; secretary-treasurer, Frank E. Gorrell, Washington, D. C.

Freezing of Fruits and Vegetables Not Without Drawbacks

Preservation by freezing—one of the oldest methods known to man—is not entirely satisfactory when applied to fresh fruits and vegetables, according to E. F. Kohman, of the research laboratories of the National Canners' Association, who pointed out that the tissue-destroying enzymes of the fruits and vegetables were not destroyed but merely inhibited, and that they will resume activity immediately upon thawing. When frozen in the raw state, the freezing process disrupts vegetable tissues to the extent that upon thawing they are soft and not in good condition. Precooking, however, leaves vegetables in a condition where they may be frozen without such injury.

The addition of sugar to fruits before freezing assists in the preservation by extracting moisture, and approaches the conditions obtaining in dehydration. Theoretically, corn sugar and levulose (fruit sugar) are twice as effective in this respect as cane sugar, owing to the smaller sizes of their molecules.

Exhaust and Head Space Are of Importance in Developing Hydrogen Springers

Many fruits, particularly the berries, will corrode the tin container and liberate hydrogen inside the can. Ultimately the hydrogen may fill the vacuum in the head space of the can and thus destroy it. A further development of hydrogen may cause the end of the can to puff out. When the end of the can can be pressed back into place it is called a springer.

G. S. Bohart, E. F. Cornell, and P. C. Wilbur, of the western branch laboratory of the National Canners' Association, have studied the development of hydrogen in cans filled to various degrees and have traced the hydrogen formation and its pressure by means of the vacuum jar. The can is placed in a glass jar and the air sucked therefrom until the pressure outside the can is less than that inside. At this point the ends of the cans flip out. The vacuum necessary to cause this puffing out, known as the flip vacuum, affords an excellent method of following the gas pressures within a can without actually puncturing it. The findings indicate that larger head spaces, affording a greater volume, in which accumulated hydrogen may collect, exhibit much less hydrogen springer formation than smaller head spaces. Suggestions were made that head spaces of between 1/8 and 1/4 in. be allowed in Royal Anne cherries, as a means of prolonging merchantability without actual underfilling. High exhausts were favored.

Corrosion-Resistant Metals Must Be Kept From Contact With Other Metals

The electro-chemical relation of metals to each other is utilized to protect metals from corrosion. Tin alone would make excellent "tin" cans were it not for its cost and softness. Therefore, it is plated upon a steel base, and as a rule it protects the iron from corrosion brought about by the contents of the can. E. F. Kohman reported that he had made cans from so-called stainless steels, such as chrome steels, chrome-nickel steels, and copper-nickel steels, and that all possessed excellent corrosion resistance when filled with foods which ordinarily give trouble in tin cans. Yet when such cans made from corrosion-resistant alloys were given a tin coating the cans corroded readily—much more rapidly than ordinary tin cans.

This striking failure of a combination of metals which individually resist corrosion has an important lesson for the canner. The present-day tendency to replace wooden brine tanks with metal tanks made from corrosion-resistant alloys must be done with proper regard for the effect of bringing corrosion-resistant metals in contact in corrosive solutions such as brines and acids. In the last year several new installations have failed to give satisfaction for that reason. Stirring equipment of a dissimilar metal brought in contact only with the outside of the tank will set up the chain of causes that bring about corrosion. The same is true of valves and piping.

Kohman recommends electrical insulation between the tank and the stirrers or piping as a means of avoiding the trouble. The stirrer may be mounted on a separate structure, and the piping may be connected to the tank by a rubber hose.

Critical Study of Pea Blanching Develops New Technical Data

When green vegetables are canned a customary preliminary step is blanching, a process consisting of boiling them either in water or in an aqueous solution of soda. The usual blanch for vegetables has been examined critically by P. L. Gowan, of the National Canners' Association, whose investigations, covering variations in temperature and time of the blanch, are a continuation of those he reported upon at the 1928 convention. Where no blanch is employed, peas have an unpleasantly strong flavor; on the other hand, when the blanch is prolonged from 5 to 20 min. at temperatures close to the boiling point,

the loss of flavor is so pronounced that after 20 min. it practically disappears. Blanching at 150 to 180 deg. F. has a similar effect, although the loss of flavor is not so complete.

Steam blanching as a substitute for hot-water blanching, with its characteristic of removing flavor, resulted in the development of an unpleasant flavor and was regarded as a failure.

The use of soda for commercial blanching was also studied, because cook books have frequently recommended it for the home. Dr. Gowan found that 1 lb. per 100 gal. had little effect; 3 lb. per 100 gal. improved the flavor and slightly softened the peas, but produced an undesirable cloudiness of the liquor; 5 lb. per 100 gal. resulted in peas becoming mushy after canning, and the brine becoming discolored.

Direct addition of soda to the brine in the can as a means of softening hard peas was a failure. Heat decomposition of the soda during the sterilizing process caused the cans to swell and buckle.

The blanch at 180 deg. F. was better for the peas, because they sink in water at that temperature, whereas peas in boiling water float and tumble about in the blancher, with the result that they are easily injured and broken.

Flavor and Color of Sauerkraut Vary With Temperature and Cleanliness

What actually goes on inside a tank of fermenting sauerkraut has long been a moot point about which few salient facts are definitely known. At the University of Wisconsin experiments which are slowly bringing out real information have been going on for a considerable period. W. H. Peterson spoke before the National Kraut Packers' Association, reviewing some of the work, a part of which has been published in the *Journal of Agricultural Research*. Vol. 34, page 79, 1927.

Measurements of the temperature of the interior of large tanks of fermenting kraut, by means of thermocouples buried in the cabbage when it was packed in the tanks, shows that the temperature rises about 5 deg. F. during the fermentation. A temperature of fermentation lying between 55 and 65 deg. F. is the optimum for the production of kraut of good flavor and color. Temperatures of 70 deg. and above effect quicker cures, but unfortunately they produce slimy kraut; on the other hand, relatively low temperatures result in slow cures, with high acid production, carrying with them the danger of producing pink-colored kraut. The latter is caused by acid-loving yeasts.

The importance of cleanliness in kraut manufacture was well demonstrated by preparing cabbage heads, for kraut cutting, by removal of unusually large proportions of the outer leaves for one set of experiments, and by the addition of small amounts of earth for the other. The former produced kraut of excellent flavor and the latter kraut of such poor flavor that is was inedible.

Dr. Peterson pointed out that the lesson to be learned from these experiments is that precautions must be taken to prevent contamination of the cabbage with soil bacteria in a manner exactly parallel to that by which the dairyman must protect his fresh milk from contamination if he hopes to have his milk or dairy products possess a good flavor.

Industrial Problems Discussed at Bacteriologists' Convention

Editorial Staff Report

ON THE OCCASION of their thirtieth annual convention at Richmond, Va., the Society of American Bacteriologists elected Ludwig Hektoen, Chicago, president to succeed Alice M. Evans, Washington, D. C. In the section devoted to Agricultural and Industrial Bacteriology a number of papers of direct interest to readers of this journal were presented. These are reviewed by L. V. Burton, assistant editor, who attended the meeting.

"Discoloration of Halibut," by F. C. Harrison and W. Sadler, McGill University, Montreal, Canada, traced the greenish-yellow discolorations on the bellies of halibut packed in ice in fishing boats to the ice obtained from upland surface waters. *Pseudomonas fluorescens,* a species of harmless bacteria, frozen in the ice, was transferred to the freshly caught fish and was the cause of the trouble.

"Significance of Thermophilic Spore-Forming Bacteria in Pasteurized Milk," by Robert S. Breed, Paul S. Prichett, and M. W. Yale, New York Agricultural Experiment Station, Geneva, brought out that large milk plants report that the growth of this type of organism is commercially undesirable because of the ensuing alteration of the flavor of the milk. They can grow only where there is a temperature sufficiently high, and there is no evidence to show that they can develop in the raw milk before entering the dairy. Hence the presence of obligate thermophilic bacteria, though perhaps troublesome, is not regarded as having any sanitary significance. Nor is there any evidence that facultative thermophilic bacteria are pathogenic. The problem appears to be a new one, associated with the growth of the dairy industry, and its development is attributed to the increasing length of time during each day that pasteurizing equipment is in use. In many large dairies the pasteurizers are now in use all day instead of the few hours formerly required.

"Outbreak of Mold in a Cheese Factory," by D. H. Dunham, University of Wisconsin, Madison, was an interesting description of a mold infection of a factory producing Liederkranz cheese. Since this cheese is one that is ripened by bacteria only, the mold infection was in effect a cheese disease. It resulted in unmerchantable product and caused serious losses. Doctor Dunham described the steps taken to overcome the infection. These presented unusual difficulties because of the fact that complete sterilization of the entire plant and equipment was out of the question. It was attempted, but when accomplished the bacteria that caused the ripening of the cheese were also destroyed, and all production ceased.

"The Acceleration of the Alcoholic Fermentation of Cane Molasses by the Use of Vegetable Carbons and Other Inert Substances," by W. L. Owen and W. P. Denson, Louisiana Experiment Station, Baton Rouge, was a discussion of the accelerating effect of small amounts of vegetable carbons on the rate of fermentation of molasses to alcohol. The acceleration is particularly noticeable in solutions of higher densities, and appears to be caused, in part, by the more rapid liberation of carbon dioxide where such carbons are present. Also the increased rate of reduction of acetaldehyde on the carbon surfaces, as well as the direct stimulating action on the yeast cells, are important factors.

"Nuts as a Possible Source of Echerichia (Bacillus) coli *Found in Candy,"* by John Weinzirl, University of Washington, Seattle, Wash., presented data which showed that nuts are not the source of *B. coli* found occasionally in candies. The colon bacillus is a normal inhabitant of the intestines of warm-blooded animals and when found elsewhere is commonly accepted as evidence of unsanitary conditions: However, Weinzirl showed that 600 samples of nuts carried the organism with less frequency than it is usually found on candy. This is interpreted to show that, as in the case of candy, the contamination is probably by the hands of the vendors rather than from manufacturing operations.

"Scope and Findings of Field Work During the Canning Season of 1928," by E. J. Cameron, Research Laboratories, National Canners' Association, Washington, D. C., was a description of the mobile laboratory of the Canners' Association and its work in the season just closed. The recent discovery that thermophilic bacteria, which sometimes cause immense financial losses, due to spoilage, may multiply in certain parts of canning factories, such as blanchers, brine tanks, and corn pre-

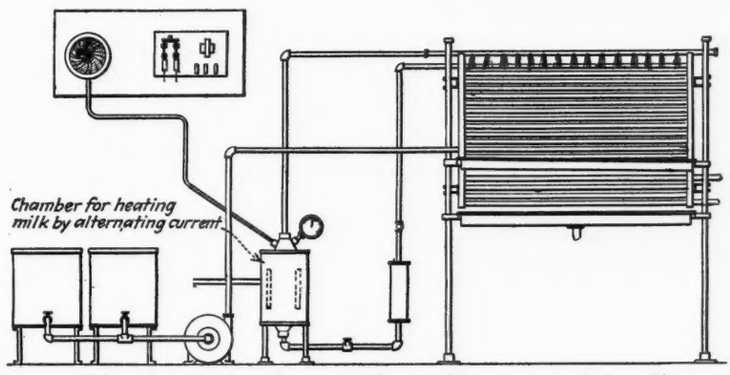

Diagram of electric pasteurizer with regenerative cooling

cooking equipment, and thereby set up a direct spoilage hazard, has made it desirable to render a laboratory service to member canners while their factories are in operation. The truck-laboratory with three men and the portable equipment rendered service to 120 factories during the active canning season. Direct spoilage hazards were found to be rare in the 1928 canning season. Out of 119 plants nine were found to have spoilage hazards.

"The Effect of Heat Produced by an Alternating Electric Current on Tubercle Bacilli in Milk," by C. M. Carpenter, New York State Veterinary College, Cornell University, Ithaca, N. Y., was a study of the efficacy of pasteurization of milk by electricity. (See U. S. Patent No. 1,692,874 abstracted on page 182 of January *Food Industries.*) It should be emphasized that the electricity does not shock bacteria to death. It merely raises the temperature of the milk by its passage through a liquid which is a poor conductor. The heat generated in this manner acts in the same way that heat from any other source would act, and if the temperature is high enough the bacteria are reduced in numbers or destroyed. The process in this case is essentially one of flash pasteurization, and tubercle bacilli, artificially inoculated into milk, were reported to be destroyed at temperatures of 155 deg. F. or above. In the ensuing discussion it was brought out that other experimenters are not in perfect agreement as to the efficacy of this temperature in the same apparatus.

"Contaminated Water as a Source of Surface Flavor in Pasteurized Creamery Butter," by Donald Bethune Shutt, of Ontario Agricultural College, Guelph, Canada, was the result of six years' study of a peculiar type of flavor change occurring in stored creamery butter. The change, occurring only on the surface of the butter, has been named "surface flavor." It has been a problem of rural creameries and has been found to be due to the presence of *Pseudomonas fluorescens* in the factory water supply. Methods of control utilized were the substitution of a pure water supply, or heating the butter wash-water to 190 deg. F. for 10 min. to kill the offending organism and neutralizing the cream to an acidity higher than normal.

"The Bacterial Flora of Pasteurized Milk," by H. A. Harding, A. R. Ward, Matthews Industries, Inc., Detroit, and H. G. Harding, Akron Pure Milk Co., Akron, Ohio, showed that the methylene blue reductase test, when carried out at 145 deg. F., can be used to determine the presence of thermophilic bacteria in raw milk. The length of time required to reduce the blue color of the dye varies from a few minutes to many hours and was recommended as a measure of the numbers of this type of organism.

"The Bacterial Count of Ice Cream Held at Freezing Temperatures," by John Weinzirl and Alice E. Gerdeman, University of Washington, Seattle, showed that temperatures of storage as low as —10 deg. C. (14 deg. F.) do not prevent the growth of bacteria in ice cream.

George Van Camp Case Gets Supreme Court Decision

BROADER interpretation of the Clayton Act is given in a recent decision by the United States Supreme Court in the case of George Van Camp & Sons Company versus the American Can Company and the Van Camp Packing Company. The opinion of the Court, delivered by Justice Sutherland, holds that discrimination on the part of a producer in selling to various units of an industry properly comes within the provisions of the act, even though the unfair competition resulting from such discrimination may be in a diffent line of business from that in which the discriminator is engaged.

In their suit, the George Van Camp & Sons Company (now bankrupt) protested that the American Can Company was selling cans to the Van Camp Packing Company 20 per cent lower than the publicly announced price. It was also charged that the American Can Company was making no charge for supplying the Van Camp Packing Company with patented machines for sealing the cans though all other users were charged for this service. These practices, it was complained, were such as to cause unfair competition in the food-packing industry.

The opinion of the Federal Supreme Court reverses the decree of the District Court of Indiana, which dismissed the case for want of equity. The Indiana court held that the Clayton Act could be applied only in cases where unfair competition was caused in the immediate business in which the discriminator was engaged.

Merrell-Soule Victor Over Northland Company

THE process and apparatus for producing a powder from a solution of solids, such as milk, covered by Patents No. 860,929 and No. 1,000,931, were held valid and infringed by Judge Denison of the Circuit Court of Appeals for the Sixth Circuit. The lower court had held that the patents were not infringed and had dismissed the suit, but on appeal by Merrell-Soule Company the higher court ruled that Northland Dairy Company had infringed upon valid patents, and the decree was reversed.

Owing to the fact that the process patent expired shortly after the suit commenced, and that the apparatus patent expired pending the appeal, the court opined that "there could be no decree excepting for an accounting." The opinion also indicates that established royalties should be the basis for damages.

A curious feature of the case was that the Merrell patent combines two operations, each of which is old in the arts, in a new and patentable form. The first of these is the evaporation of the milk in a vacuum pan to a suitable concentration; the second step is spray drying in a current of warm air.

The validity of the Merrell patents was attacked chiefly upon the basis of the Stauf patent, No. 666,711, which covers the spray drying of milk by a single step, as contrasted with the two-step process of Merrell. The court held that the two-step process was an improvement over the one-step: that it produced a denser and better keeping milk powder, and involved less danger of injury of the product.

"Jell-O" vs. "Enzo-Jel"

Postum Cereal Company, Inc., lost its case against Enzo Jel Company when it opposed the latter in its use of the trade mark "Enzo-Jel." The Postum Company appealed from the decision of the acting examiner of interferences, claiming that there was sufficient similarity between the names "Jello-O" and "Enzo-Jel" to confuse the public. The commissioner of patents upheld the lower decision.

New Pecan Shellery

The Texokola Pecan Shellers, Incorporated, has been recently formed by W. L. Iuppenlatz and E. M. Zerr at San Antonio, Texas, to operate a pecan shellery, which will be located at 414 South Medina Street.

Glacial Acetic Acid

Edible quality of glacial acetic acid, as well as lower grades of this acid, is being manufactured by Niacet Chemicals Corporation of Niagara Falls, N. Y. Shipments are made in returnable aluminum drums, or in tank cars.

"Nori Tsukudani"

Ruling that "nori tsukudani," consisting of seaweed that has been dried, cut up, cooked with shoyu and canned, was a sauce, and therefore properly dutiable at 35 per cent, the United States Customs Court denied the protest of T. Sumida and Company, Ltd. of Honolulu which had asked for a duty of 10 per cent on the theory that it was a prepared seaweed.

Wagner Electric Appointment

Wagner Electric Corporation, St. Louis, Mo., announces the addition of N. H. Spencer to its Dallas, Tex., sales force. Mr. Spencer's twenty years' experience in the electric field includes the management of the Olean Electric Light and Power Company, Olean, N. Y.; five years as district manager of the Niagara, Lockport & Ontario Power Company; and eight years with the Pittsburgh Transformer Company.

Paper Containers for Milk

Experimental plans for the use of paraffin-lined cardboard containers in place of glass bottles for the distribution of milk and cream are being studied by the Market Milk Investigations section of the Department of Agriculture. Although it is understood that cardboard containers are being used at present in some sections in the retail milk trade, Washington officials believe that several points must be worked out before the practice can be employed on a large scale.

It is pointed out that with glass bottles the public is afforded a means of seeing the richness of the milk and cream it buys. None of the cardboard containers submitted to the Dairy Bureau of the Agricultural Department provides means for disclosing a view of the contents.

In other respects, chiefly in the elimination of the work and equipment necessary for sterilizing bottles, it is agreed that the cardboard containers possess many advantages. Officials of the Milk Investigations Division believe that retail stores would receive greater benefit from the use of cardboard containers than the customer distribution service of the dairies, because more bottles are lost in the store trade.

Beverage Merger

Formation of the American Beverage Corporation was announced on Jan. 5 by E. C. McCullough, president of Carl H. Schulz Corporation, New York. The new company is to acquire the common stock and much of the preferred stock of Carl H. Schulz Corporation, Schoneberger & Noble, Inc., and Brownie Corporation. It is understood that the manufacturing operations of all three companies are to be combined in a new plant in Brooklyn. The ultimate purpose of the merger is to acquire other beverage companies with the view of forming a nation-wide chain of manufacturers, bottling a complete line of soft drinks.

C. E. George Joins Taylor Instrument Company

C. E. George, for many years western manager of the American Schaeffer & Budenberg Corp., has joined the sales staff of the Taylor Instrument Companies of Rochester, N. Y. He will be associated with the Chicago office of the company with headquarters at 58 East Washington Street, Chicago, Ill.

C. J. C. Clarke With Wightman-Hicks, Inc.

Wightman-Hicks Inc., of New York, industrial advertising and merchandising, announces that C. J. C. Clarke has become a vice-president of their organization. Mr. Clarke has had wide experience as sales manager and advertising manager for various companies. For the last three years he has been identified with the McGraw-Hill Publishing Company, Inc.

Continental Can Company Continues to Grow

The business and assets of the Manhattan Can Company, Brooklyn, a company organized in 1918, have been sold to Continental Can Company. The business, which will be transferred to one of the Continental plants, has consisted largely of talcum powder and fancy toilet boxes.

Further expansion of the Continental Can Company is the acquisition of the business of the Manufacturers Can Company, Harrison, N. J., which makes a wide variety of miscellaneous cans for paint, oil, and grease. As with the Manhattan Can Company, the business will be removed from its present quarters to one of Continental's plants.

Since the beginning of 1928, Continental Can has acquired nine companies manufacturing tin containers, and one manufacturer of can-making machinery.

PERSONALS

RALPH HERMAN has accepted a position with General Mills Inc., and will be located at Buffalo.

ROBERT J. PEEBLES, Union City, Ind., is acting temporarily as manager of the plant of the Foulds Milling Company at Franklin, Ind.

LESLIE R. OLSEN has been appointed a member of the Research and Experiments Committee of the American Society of Baking Engineers.

M. A. GRAY, of the Pillsbury Company, Minneapolis, has been promoted to the position of general director of production control of that company.

H. M. MAY, who has been manager of the lemon byproducts plant of the California Fruit Growers Exchange at Corona, Calif., resigned recently.

E. G. MINER, president of the Pfaudler Company, has been elected to the directorate of the Buffalo, Rochester and Pittsburgh Railroad Company.

RALPH HERMAN, assistant sales manager of the Larabee Flour Mills, has resigned to join the Products Control Department of General Mills, Inc., Buffalo.

GEORGE W. COBB, JR., of the American Can Company, Maywood, Ill., son of George W. Cobb, general sales manager of the American Can Company, was married on Dec. 19, to Miss Virginia Field Reiland, of New York City.

C. P. MCCORMICK, of McCormick and Company, Incorporated, of Baltimore, has been elected vice-president of the company. Mr. McCormick is president of the Mayonnaise Products Manufacturers' Association of America, Inc.

PAUL FORSYTH, formerly of the J. G. White Company, New York, and the Detroit Edison Company, who has been with the Wagner Electric Company, St. Louis, for the last thirteen years, has been appointed branch manager of that firm's Cincinnati office.

FRANK B. DEMOTTE, who has been connected with the Warrensburg Canning Company, of Warrensburg, Ill., since 1915, successively as superintendent, manager, and vice-president, has sold his interest to L. A. Sears and severed his connection with the business.

C. B. MORISON, of the American Institute of Baking, Chicago, is chairman of the employment committee of the American Association of Cereal Chemists, which is acting as a clearing house for employers needing the services of cereal chemists and for members of the association seeking employment.

HARRY MCCORMACK has resigned from Brunswick-Balke-Callender Company, where he has been consulting chemical engineer for the last six years,

and will engage in general consulting practice in chemical engineering in Chicago. He will also teach that subject at the Armour Institute of Technology in that city.

DR. E. F. KOHMAN is the author of a recent publication from the research laboratory of the National Canners Association, entitled, "Respiration in Fruits and Vegetables," Association Circular No. 16-L. He cites recent scientific researches which indicate that for the preservation of fresh fruits the inert gases have limited applicability.

R. J. THOMPSON, mechanical engineer of the research laboratories of the National Canners Association, Washington, D. C., has resigned to join the research staff of the American Can Company at the Maywood, Ill., laboratory. For several years Mr. Thompson has been engaged principally in studies involving heat penetration.

C. P. WILSON, who has been manager of the research department of the California Fruit Growers Exchange laboratories at Ontario, Calif., has been elected assistant general manager of the exchange. Mr. Wilson will still retain his work as director of the research department. The California Fruit Growers Exchange operates plants in Ontario and Corona, Calif., for the manufacture of citrus byproducts.

OBITUARY

JAMES HARRIS, 51, managing director of the Harris Abattoir Company, Toronto, died in that city on Jan. 1.

GEORGE H. HINDERSMAN, 77, died in Cincinnati on Jan. 2. He had been president of the Hindersman Flour Company for the last twenty years.

FRANK D. CLEARMAN, cocoa broker, senior partner of the Snyder & Wheeler Company, New York, died on Dec. 28 in a hospital in Newark, N. J. He had enjoyed a continuous connection with his firm for 45 years.

WILLIAM P. RIDER, 52, died early in January at his home in Bloomington, Ind. Mr. Rider was head of the Rider Packing Company, which owned several plants with headquarters at Crothersville, Ind., until it was combined with the Tecumseh-Plainville Canning Company to form the corporation now known as the Vincennes Packing Company. His brother, Howard R. Rider, who was associated with him in the canning business, died about four years ago.

DR. GEORGE L. MCKAY, 71, Secretary of the American Association of Creamery Butter Manufacturers, died on Dec. 19, at the Garfield Memorial Hospital, Washington, D. C. He began life on a farm in Ontario, and at nineteen learned cheese making, superintending a plant at twenty. Later he managed a plant in Iowa, afterward being associated with Iowa State College and becoming a full professor (in 1900). The honorary degree of Doctor of Science was conferred upon him. He became Secretary of the American Association of Creamery Butter Manufacturers in 1908.

ROSCOE H. SHAW, director of the educational department of the Evaporated Milk Association, Chicago, died on Dec. 18 after a brief illness, at the age of 53. After graduating from the University of New Hampshire, Mr. Shaw studied chemistry at home and abroad. He had been connected with the Dairy Division of the United States Department of Agriculture and with the universities of Wisconsin, Missouri, Nebraska and Kansas as chemist, teacher, and research worker. His own publications were numerous, and he collaborated with others in many reports of researches. While in the Daily Division he devised the "Shaw Test" for fat in butter, a description of which was published in U.S.D.A., Circular 202. The "Shaw Test" has lately been incorporated into a set of apparatus for the convenience of creameries using it. For four years Mr. Shaw was connected with the American Institute of Baking in charge of the nutritional research and as editor of *Baking Technology*.

· NEW · CONSTRUCTION ·

Factory and Equipment Requirements

Bakery — Barker's Bread Ltd., 285 Spadina Ave., Toronto, Ont., plans the construction of a 4 story bakery at Fleet St. and Davenport Rd. Estimated cost $300,000. E. Sheppard, 57 Queen St. W., Toronto, is architect. Owner is in the market for bakery supplies and equipment.

Bakery — The City Bakery, c/o F. W. Sampson and S. Johnson, Minot, N. D., plans the construction of a 3 story bakery, etc. on Main St. Estimated cost $30,000. Architect not selected.

Bakery—Gordon Baking Co., 2303 East Vernor St., Detroit, Mich., will receive bids late in April for the construction of a bakery on Van Alt Ave., Long Island City, N. Y. Estimated cost $100,000. F. S. Parker, 119 West 57th St., New York, N. Y., is architect.

Bakery — Purity Bakeries Corp., 711 South 10th St., Newark, N. J., will receive bids about Feb. 1 for a 3 story addition to bakery. Estimated cost $40,000. R. H. Brown, 844 Rush St., Chicago, Ill., is architect and engineer.

Bakery — A. Sabourin, Notre Dame St., Hull, Que., plans the construction of a bakery on Notre Dame St. Estimated cost $20,000.

Beverage Mfg. Plant — Orange Crush Bottling Co., c/o W. D. Boost, V.-Pres., 4900 Flournoy St., Chicago, Ill., is having preliminary plans prepared for the construction of a beverage manufacturing plant on Sabine-Neches Ship Channel near Port Arthur, Tex. Estimated cost $400,000.

Biscuit Factory — National Biscuit Co., R. E. Tomlinson, Pres., 85 9th Ave., New York, N. Y., is receiving bids for a 1 story factory at Beacon, N. Y. Estimated cost $30,000. L. Wirsching, Jr., 85 9th Ave., New York, is architect.

Bottling Plant — Coca Cola Bottling Co., Fort Myers, Fla., will soon receive bids for the construction of a bottling plant. Work will probably be done by day labor.

Bottling Plant — Colonial Beverage Co. Inc., 125 Brookline St., Cambridge, Mass., is receiving bids for alterations and two 1 story additions to bottling plant at 139-141 Hampshire St. Private plans.

Bottling Plant — Long Island Beverage Co., 174 Jamaica Ave., Astoria, L. I., N. Y., had plans prepared for the construction of a 2 story, 50 x 100 ft. bottling plant at Grand Ave. and Sherman St. A. H. Eccles, 76 Hoyt St., Astoria, L. I., is architect.

Candy and Ice Cream Plant—Rucker Candy & Ice Cream Co., 601 Grant St., Amarillo, Tex., plans the construction of a factory. Estimated cost $35,000. H. R. Guiberson, 813 Oliver Eackle Bldg., Amarillo, is architect.

Cannery—G. F. Otis & Associates, and Yuba City Chamber of Commerce, Yuba City, Calif., are forming a corporation and plan the construction of a peach canning plant.

Canning Equipment—Lapel Canning Co., Lapel, Ind., is in the market for canning equipment including corn cutters and fillers.

Canning Plant — Vincennes Packing Co., Seymour, Ind., awarded general contract for the construction of a 1 story, 60 x 80 ft. canning plant to Reuter & Brethauer, 509 South Poplar St., Seymour. Estimated cost $45,000.

Canning Plant—Quebec Canners Corp., St. Francois St., St. Hyacinthe, Que., will build a 1 and 2 story, 30 x 200, 50 x 150 and 40 x 200 ft. canning plant on Bourdages St. Estimated cost $120,000. Work will be done by day labor.

Canning Plant Equipment — Van Camp Packing Co., F. W. M. McKee, Pres., 2002 South East St., Mt. Vernon, Ind., plans to purchase machinery and equipment to cost $50,000 for canning plant at Elwood, Ind.

Cheese Making Equipment — Kraft Phoenix Cheese Co., 400 Rush St., Chicago, Ill., is in the market for equipment for the manufacture cheese and cheese products for proposed plant at Red Key, Ind.

Cold Storage Plant—Central Power & Light Co., F. C. Ludden, Dist., Mgr., San Benito, Tex., will build a cold storage plant at Harlingen. Estimated cost $65,000. J. M. Marriott, Frost National Bank Bldg., San Antonio, is engineer.

Cold Storage Plant, etc.—Dept. of Welfare, J. E. Harper, Dir., Columbus, O., will soon award contract for a 1 story, 95 x 125 ft. cold storage plant, etc., at Cleveland. H. B. Briggs, Hartman Hotel Bldg., Columbus, is engineer.

Cold Storage Warehouse—Cuyahoga Cold Storage Co., L. Malbin, 3542 Croton Ave., Cleveland, O., awarded contract for a 3 story, 80 x 80 ft. cold storage warehouse to J. Boman, 1679 Coventry Rd., Cleveland. Estimated cost $150,000.

Cold Storage Plant and Warehouse — Abdou Poultry & Produce Co., 700 South Santa Fe St., El Paso, Tex., awarded contract for the construction of a 3 story cold storage plant and warehouse to R. E. McKee, El Paso. Estimated cost $200,000.

Creamery — Louisiana State University, Baton Rouge, La., awarded contract for a 2 story creamery to Burkes Co., East Boulevard, Baton Rouge. Estimated cost $40,000.

Creamery—Traer Co-operative Co., N. O. Bendickson, Mgr., Traer, Ia., is having plans prepared for the construction of a 1 and 2 story creamery at Hereford, Tex. Estimated cost $60,000. Machinery and equipment will be required.

Creamery and Packing Plant—Swift & Co., Packers and Exchange Aves., Chicago, Ill., plans the construction of a 5 story, 100 x 100 ft. creamery and packing plant at Lebanon, Tenn. Estimated cost $250,000.

Dairy Plant—Duroc Farm Corp., Tuscaloosa, Ala., will build a dairy plant at Prattsville. Estimated cost $150,000.

Flour Mill and Grain Elevator—A. M. Dollar, 425 Howe St., Vancouver, B. C., is having sketches made for the construction of a 2,500 bu. flour mill and 500,000 bu. grain elevator at Barrard Inlet, North Vancouver. Estimated cost $1,000,000. L. T. Albin, 470 Granville St., Vancouver, is engineer.

Flour Mill — D. D. Baker, 133 West Woodlawn Ave., San Antonio, Tex., and J. Freeman, Seguin, Tex., have acquired the plant of Quality Flour Mills near Austin and plans extensions and improvements. Machinery and equipment will be required.

Grain Elevator, etc. — Dept. of Public Works, Ottawa, Ont., will soon award contract for the construction of a grain elevator at Prescott, Ont., in connection with harbor improvements. Estimated total cost $1,000,000. K. M. Cameron, c/o Dept. of Public Works, Ottawa, is engineer.

Grain Elevator—General Mills Inc., Minneapolis, Minn., awarded contract for the construction of a grain elevator, 1,500,000 bu. capacity to Jones Hettelsater Construction Co., 708 Mutual Bldg., Kansas City, Mo.

Grain Elevator — Kansas Flour Mills Co., Postal Bldg., Kansas City, Mo., will soon receive bids for the construction of a grain elevator at North Kansas City, Mo. Private plans.

Grain Elevator—Sarnia Elevator Co., G. Leach, Mgr., Sarnia, Ont., awarded contract for addition to grain elevator to Fegles Construction Co., Fort William, Ont. Est. cost $500,000.

Grain Elevator Addition—Kansas City Flour Mills Corp., Postal Bldg., Kansas City, Mo., awarded contract for addition to grain elevator, 3,000,000 bu. capacity to include 36 tanks, 95 ft. high to Industrial Engineering Co., 620 Exchange Bldg., Kansas City, Mo. Estimated cost $450,000.

Grocery Warehouse—Demott Grocery & Commission Co., Eudora. Ark., awarded contract for a 78 x 147 ft. warehouse on Main St., to E. V. Overton, Eudora.

Grocery Warehouse—Frankford Grocery Co., Inc., M. D. Sickel, Secy., Philadelphia, Pa., is having plans prepared for addition to warehouse at Pennsylvania and Unity Sts. Estimated cost $200,000. W. E. S. Dyer, Land Title Bldg., Philadelphia, is architect.

Ice Plant—E. W. Baker & Co., Perrine Bldg., Oklahoma City, Okla., is having preliminary plans prepared for the construction of a 10 ton ice plant at Konawa, Okla. Estimated cost $25,000. Private plans.

Ice Plant—R. M. Boyd, Tuskegee, Ala., has acquired a site and plans the construction of an ice plant.

Ice Cream Plant—Midwest Dairy Products Co., Duquoin, Ill., will soon award contract for a 2 story, 100 x 200 ft. ice cream plant, on West Main St. between Seventh and Eighth Sts. Estimated cost $100,000. Architect not announced.

Ice Plant—R. F. Brand, J. M. Gibbs, B. H. Baine, & Associates, Houston, Miss., plan the construction of a 12 ton ice plant.

Ice Plant — Burnett, White & Co., Sulphur Springs, Tex., plans the construction of a 15 ton ice plant. Estimated cost $32,000. Private plans.

Ice Plant—City of Denton, Tex., is receiving bids for the construction of a 45 ton ice plant including machinery and equipment. Estimated cost $50,000. B. W. McKenzie, is mayor.

Ice Plant — Dry Ice Corp. of America, Elizabeth, N. J., awarded contract for a 60 ton ice plant at Niagara Falls, N. Y. to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $250,000.

Ice Plant — R. L. Hill, Alvarado, and L. B. Martin, Itasca, Tex., plan the construction of a 25 ton ice plant at McAllen, 20 ton plant at Harlingen and 25 ton plant at Brownsville, Tex. Estimated cost $50,000, $45,000 and $60,000 respectively. Private plans.

Ice Plant—Knickerbocker Ice Co., 41 East 42nd St., New York, N. Y., will soon award contract for the construction of an ice plant at West 16th St. and Hart Pl., Brooklyn, C. L. Weir, c/o owner, is architect.

Ice Plant—Krumar & Burnstein, c/o W. Clifford, Jr., 293 Morris Ave., Elizabeth, N. J., Archt., is having plans prepared for the construction of an ice plant at South 7th St. and Elizabeth River. Estimated cost $50,000.

Ice Plant—R. L. Lea, Levelland, Tex., plans the construction of an ice plant. Estimated cost $35,000.

Ice Plant—Mountain Ice Co., 51 Newark St.. Hoboken, N. J., will build an ice plant at Lincoln and John Aves., Kearny. Estimated cost $40,000. F. Fink, 100 Sylvan Ave., Newark, is architect and engineer.

Ice Plant — E. R. Price & Associates, Gadsden, Ala., will build a 25 ton ice plant.

Ice Plant—E. J. Roberts, Munday, Tex., awarded contract for the construction of a 20 ton ice plant to Murphy & Murphy, Mineral Wells, Tex. Private plans.

Ice Plant—Pawtucket Ice Co., H. L. Russell, 126 Main St., Pawtucket, R. I., will soon receive bids for the construction of a 60 x 110 ft. artificial ice plant. R. E. Palmer, 58 Suffolk St., Holyoke, Mass., is architect. York Ice Machinery Corp., 200 Causeway St., Boston, Mass., is engineer.

Ice Cream Plant — O. K. Ice Cream & Candy Co., Pine Bluff, Ark., will soon receive bids for a 2 story, 80 x 165 ft. ice cream plant at 8th and Main Sts. Estimated cost $100,000. M. Seligman, National Bank Bldg., Pine Bluff, is architect.

Ice Plant—Spiller Grain & Cold Storage Co., Brady, Tex., plans the construction of a 9 ton ice plant in connection with cold storage plant.

Ice Plant—Southwestern Light & Power Co., E. R. Ernsberger, Pres., 517 Braniff Bldg., Oklahoma City, Okla., plans the construction of a 20 ton ice plant at Temple, Okla. Estimated cost $25,000.

Ice Plant—Toledo Ice & Fuel Co., J. M. Murphy, Pres., Jefferson Ave., Toledo, O., awarded contract for 2 story, 100 x 100 ft. ice plant on Woodruff St. to Charles Coneby Co., 1556 Ansel Rd., Cleveland. Estimated cost $200,000.

Ice Storage Building—Boston Ice Co., 110 State St., Boston, Mass., awarded contract for the construction of a 1 story ice storage building at Spruce and Maple Sts., Chelsea, Mass. to C. S. Cunningham Sons Co., 80 Boylston St., Boston. Estimated cost $40,000.

Ice and Cold Storage Plant Addition — Artificial Ice & Cold Storage Co., C. A. Goll, Gen. Mgr., 316 West Ohio St., Indianapolis, Ind., plans the construction of a 1 story addition to ice plant at 42nd and Winthrop Sts. Architect not selected.

Ice and Packing Plants—Caps & Parker, Donna, Tex., will build a 60 ton ice plant, also packing plant on Third St.

Meat Distribution Plant—Swift & Co., 60 North Market St., Boston, Mass., awarded contract for a 2 story, 75 x 80 ft. meat distribution plant at Malden, Mass. to Somers & Drisko, 31 St. James Ave., Boston. Estimated cost $85,000.

Meat Products Plant—Joseph Phillips Sausage Co., F. A. Spicer, Pres., Center Market, Washington, D. C., will receive bids about Mar. 7 for a 2 and 3 story meat products plant at Patterson Tract N.E. Estimated cost $250,000. Henschien & McLaren, 1632 Prairie Ave., Chicago, Ill., are architects and engineers.

Milk Condensery — Borden-Southern Co., Waco, Tex., awarded contract for the construction of a 1 story milk condensery plant to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $250,000. Owner is in the market for equipment.

Milk Depot—Schaeffer Milk Co., 51 East Bigelow St., Newark, N. J., will build a 1 story milk depot to include electric refrigeration system and high pressure steam bottle washers. Estimated cost $40,000. S. Cohen, 134 Branford Pl., Newark, is architect.

Milk Pasteurizing Plant—Dept. of Public Works, Municipal Bldg., Buffalo, N. Y., will receive bids until Jan. 30 for the construction of a milk pasteurizing plant at J. N. Adam Memorial Hospital, Perrysburg, N. Y.

Packing Plant Addition—T. M. Sinclair & Co. Ltd., R. S. Sinclair, Pres., 3 and 16 Ave., Cedar Rapids, Ia., is having preliminary plans prepared for the construction of a 3 story addition to packing plant to include beef house, loading dock, 18 x 350 ft., etc. Estimated cost $374,000.

Milk and Ice Plant—Pure Milk & Ice Co., c/o S. B. Hater, Pres., West Main St., Nachogdoches, Tex., will soon award contract for the construction of a milk and ice plant to inciude refrigeration for milk, milk bottling equipment and small ice machinery plant for producing ice. Estimated cost $50,000. Private plans. Machinery and equipment to cost $35,000 will be required.

Packing Plant—American Packing Corp., Evansville, Ind., is having plans prepared for the construction of a 2 story, 60 x 250 ft. packing plant. Estimated cost $50,000. Fowler & Karges, Furniture Bldg., Evansville, Ind., are architects.

Packing Plant—Banfield Bros. Packing Co., 915 East Apache St., Tulsa, Okla., is having plans prepared for the construction of a packing plant. Estimated cost $75,000. A. J. Love & Co., 204½ East Third St., Tulsa, are architects.

Packing Plant — R. Gardens, c/o P. Matzinger, 1227 Prospect Ave., Cleveland, O., is having plans prepared for the construction of a 1 story, 64 x 100 ft. packing plant at Orville, O. Estimated cost $40,000.

Packing Plant—Placentia Orange Association, Pasadena, Calif., is having plans prepared for a 2 story, 100 x 200 ft. packing plant. Estimated cost $35,000. W. P. Shepherd, 15 South El Molino, Pasadena, Calif., is architect.

Packing Plant — Pontiac Packing Co. Inc., F. M. Kirby, Pres., 49 Turk St., Pontiac, Mich., plans to rebuild 1 and 2 story packing plant destroyed by fire. Estimated cost $25,000.

Milk Products Plant — Stock Company, c/o Douthitt Engineering Co., 100 Monroe St., Chicago, Ill., Engr., plans the construction of a 2 story milk products plant at Tyler, Tex. Estimated cost $200,000. Machinery and equipment for the manufacture of powdered milk and by-products will be required.

Poultry Plant—Michigan State College, H. Halladay, Secy., East Lansing, Mich., is having plans prepared for the construction of a 2 story poultry plant. Estimated cost $35,000. Bowd & Munson, 400 Wilson Bldg., Lansing, are architects.

Pre-Cooling Plant — Anaheim Co-operative Citrus Assn., Anaheim, Calif., is having plans prepared for a 2 story pre-cooling plant. Estimated cost $75,000. Hamm, Grant & Bruner Inc., Ferguson Bldg., Los Angeles, are engineers.

Produce and Creamery Plant—Western Produce Co., c/o B. White, Abilene and R. White, Lubbock, Tex., will receive bids about Jan. 22, for a 2 story produce and creamery plant including refrigeration system, equipment, etc. at Lubbock. Estimated cost $175,000. Private plans.

Produce House and Creamery — Western Produce Co., c/o R. White, V. Pres. and Gen. Mgr., Lubbock, Tex., plans the construction of a produce house and creamery to include refrigeration system, boilers, ice machines, etc. at 4th St. and Ave. K. Estimated cost $200,000. Private plans.

Produce Terminal—Detroit Union Produce Terminal Co., F. Isbey, Chn., 142 12th St., Detroit, Mich., awarded contract for the construction of a 1 and 2 story 70 x 700 and 70 x 1,000 ft. produce terminal to include loading docks, etc., on West Fort St., to Dwight P. Robinson Co., 125 East 46th Street, New York, N. Y. Estimated cost $5,000,000.

Refrigeration Plant — Manhattan Refrigerating Co., 525 West St., New York, N. Y., will receive bids about Mar. 1, for the construction of a refrigeration plant. Gunvald Aus, 244 Madison Ave., New York, is engineer.

Salmon Packing Plant — Fisherman's Packing Co., Everett, Wash., plans additions to salmon packing plant to double capacity of plant. Estimated cost $75,000.

Sugar Refinery—Western Sugar Refining Co., 2 Pine St., San Francisco, Calif., is having plans prepared for a 1 and 2 story, 140 x 320 ft. warehouse for sugar refinery on 23rd St. Estimated cost $200,000. H. J. Brunnier, Sharon Bldg., San Francisco, is engineer.

Sugar Refinery Addition — National Sugar Refining Co. of New Jersey, 129 Front St., Long Island City, N. Y., plans the construction of addition to plant at 54th Ave. and Second St. Estimated cost $40,000.

Winery—H. Robinson Co., H. Robinson, Mgr., Catharine and Robert Sts., Hamilton, Ont., plans installation of complete new equipment for the manufacture of wines, for winery to be remodeled. Estimated cost $100,000.